# Electrical World

FEBRUARY 19, 1944

CENTRAL CONTROL FOR AIRCRAFT PLANT DISTRIBUTION

# OUTDOOR REACTORS—Murray

they save space and costly structures—

The weatherproof qualities of Murray Cur
Limiting Reactors are absolute. The windi
are encased in solid, waterproofed concre
so poured that the copper conductors h
ample breathing space. The low degree
temperature rise is typical of the general ex
lence of construction and performance.

## Absolutely WEATHERPROO
— all windings encased in weatherproof concre

Obviously, no protective structures are nee
This saves materials and manpower —
time, when extra reactor capacity is requi
The splendid performance record of Mu
Reactors, over more than two decades, toge
with their widespread use, commends t
to your careful consideration. Metropol
Device Corporation, Brooklyn 16, New Y

# Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 70 YEARS

February 19, 1944 — Vol. 121, No. 8


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From .....

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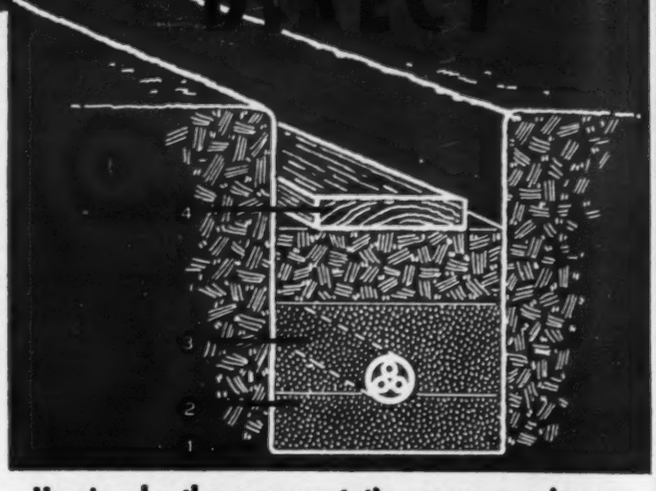
To .....

.....

Signed .....

# This is the Way to Install Cable

## WHEN BURYING IT DIRECT



While certain types of underground cable for direct burial are often plowed in, when installing the more expensive high tension cables, or cables for extremely critical circuits, further precautions will prolong their useful life and prevent service interruptions caused by mechanical damage, regardless of the type of insulation and covering used.

### HERE'S HOW IT'S DONE:

1. Dig trench deep enough (at least 18-in.), so cable will not be disturbed by plowing, surface digging or paving excavation.

2. It is preferable to lay a sand cushion, or at least have base of trench loosened so it is cleared of rocks and other rough projections.

3. After laying cable and before backfilling, cover it with soft earth or sand, free from stones, rocks, etc., so they won't press against the cable when flooding or frost-heaving disturbs the surrounding earth.

4. A creosoted plank or concrete slab, laid six to eight inches above the cable, gives additional protection and warns workmen of its presence when digging over the cable.

Under highways and railroad rights-of-way, it is usually best to pull the cable through a pipe or conduit.

Such protection is particularly desirable for non-metallic underground cable. But even when metallic-armored (steel taped, etc.) cable is used, it is desirable to have this more complete protection. Naturally, the extent of protection depends upon the type of soil as well as the likelihood of disturbance, such as in urban areas where the majority of digging and excavating occurs.

### Here's why these preventative measures increase the life of cable:

**a** Rocks and other sharp projections will not bruise or deform the cable insulation if extraordinary pressures develop.

**b** Better packing permits improved heat dissipation and paves the way for longer cable life and greater efficiency.

Hazard engineers are experts in the production, installation and maintenance of electrical wires and cables. Why not consult them about *any* cable problem?

---

*Even the best installation practice does not help much unless the original cable is properly designed. To relieve any doubt specify:*

**HAZARD INSULATED WIRE WORKS**
DIVISION OF THE OKONITE COMPANY
**Works: Wilkes-Barre, Pennsylvania**
*Offices in Principal Cities*

3226

**Hazard Armortite non-metallic underground**

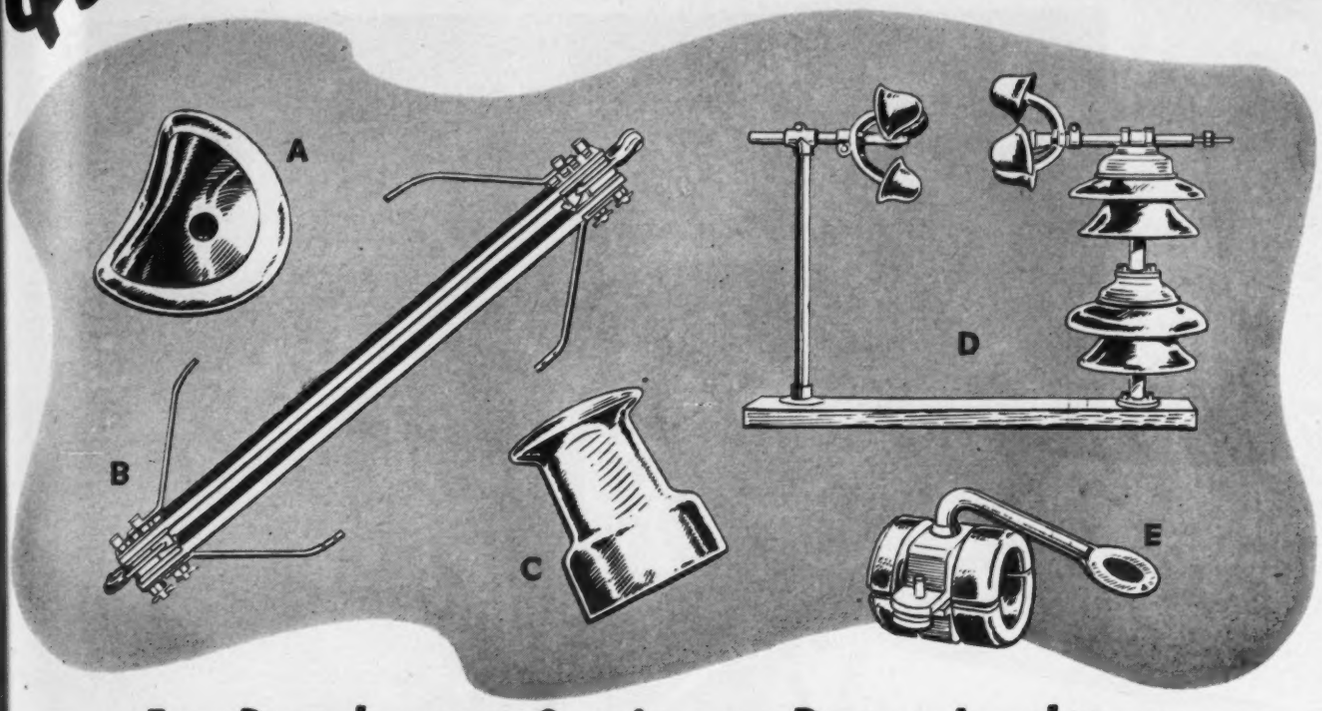
# HAZARD

ARMY E NAVY

**Electrical Wires and Cables**

**Hazard lead and steel-taped Parkway**

# QUIZ: DO YOU KNOW THE RIGHT SPOT FOR EACH OF THESE INSULATORS?




## *For Broad-range Service on Power Insulators Make GRAYBAR Your Source of Supply*

● Leading makers of insulators and insulator hardware depend on GRAYBAR as a *local* link with utility companies, contractors and other users of pole-line equipment.

GRAYBAR Representatives make it a point to keep fully informed on your individual needs and specifications. Wherever possible, GRAYBAR keeps the insulators you regularly use in convenient local stocks. On special items, GRAYBAR can act fast to seek them out.

As new designs are introduced to meet tomorrow's fast-changing pole-line requirements, you can count on GRAYBAR to keep you fully informed. Because GRAYBAR offers all the products that *go together* on the pole, you're well protected from misfits. Whether it's porcelain, glass or wood, for transmission or distribution, rural or urban, GRAYBAR is logically your *first* source of supply. Your future planning, too, may be simplified with our help.

97

**Here are the ANSWERS** (INVERT PAGE)

**A** – Porcelain link strain insulator for low voltage work, shaped for good drainage in any position.

**B** – Wood strain insulator for guy lines, with dual members for extra strength.

**C** – Standard glass insulator for power-line service.

**D** – Control gap for station protection.

**E** – Lamp lead bracket to carry lead wires on street lighting mast arms.

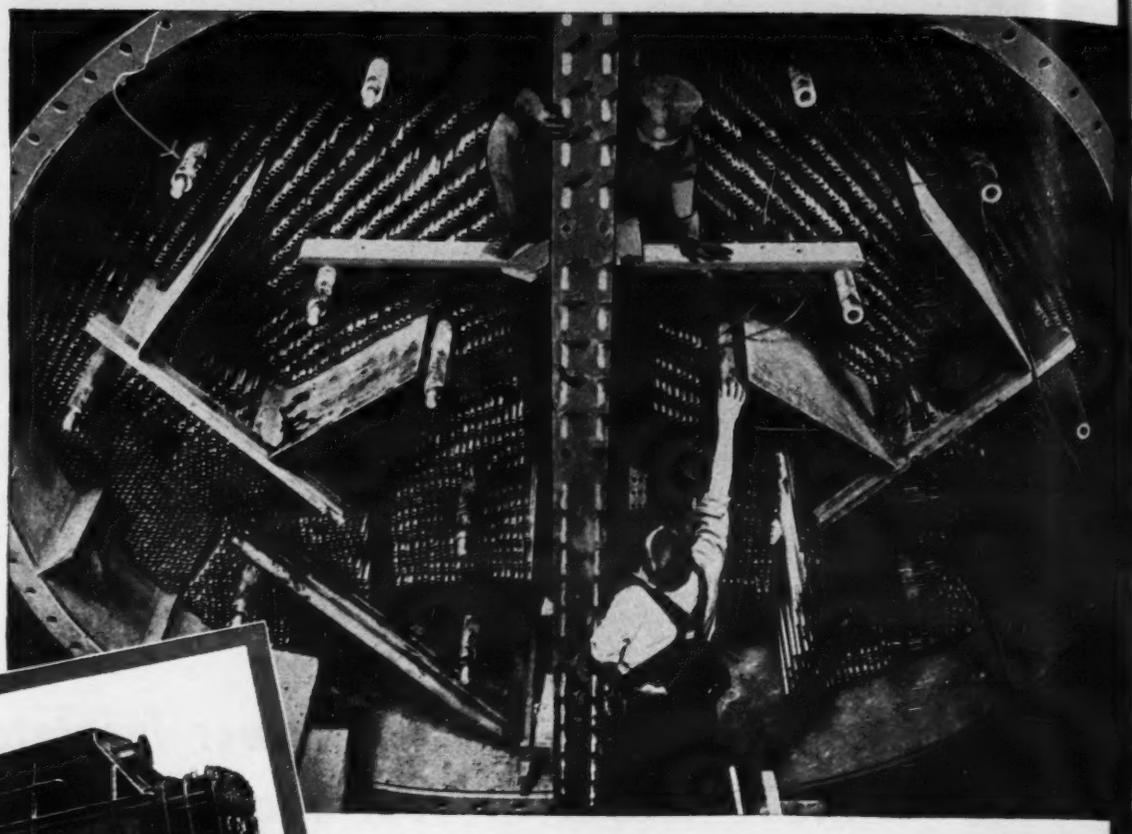
75 YEARS OF Electrical Distribution

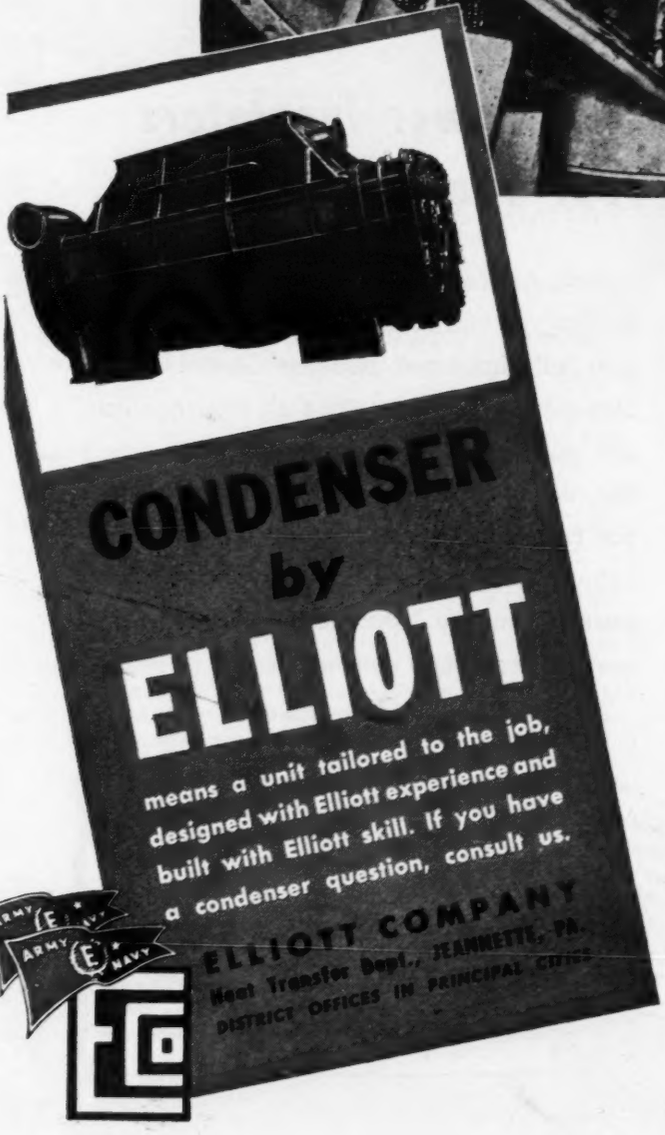
# GraybaR

IN OVER 80 PRINCIPAL CITIES

Executive Offices: GRAYBAR BUILDING, NEW YORK 17, N. Y.

# Every tube in the right place!



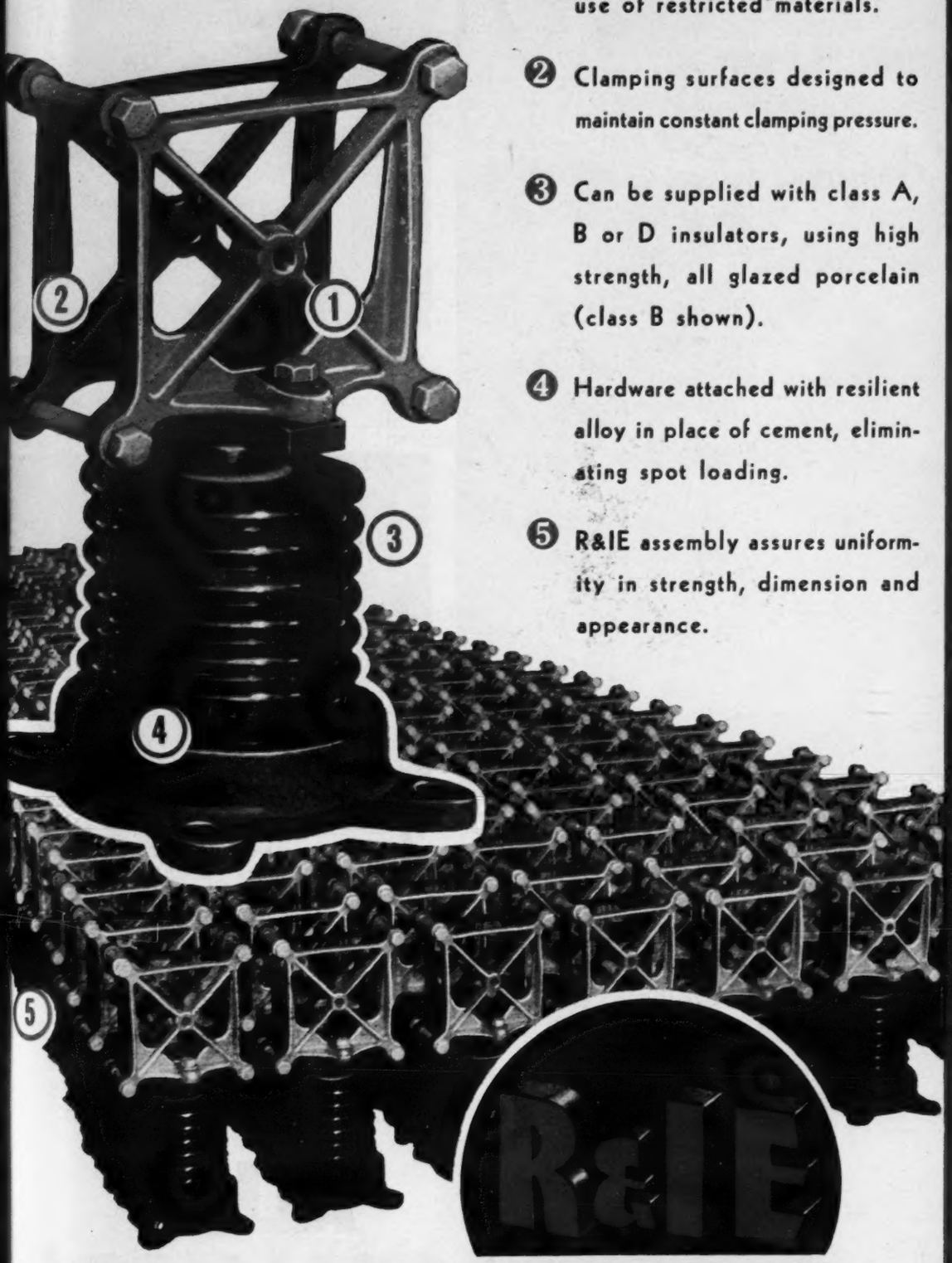

CONDENSER
by
ELLIOTT
means a unit tailored to the job, designed with Elliott experience and built with Elliott skill. If you have a condenser question, consult us.
ELLIOTT COMPANY
Heat Transfer Dept., JEANNETTE, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES
ARMY
NAVY

Exceptional condenser performance comes down to tube layout more than to any other single factor. Elliott engineers have worked out a distribution of tubes in converging straight lines—wide spacing at the top, decreasing to a minimum toward the point of lowest pressure at the air offtakes. This type of spacing insures uniform, maximum steam velocity which sweeps the tubes clear of condensate and non condensable gases.

A central steam lane feeds directly to the hotwell, assuring equal pressure and temperature at top and bottom of the unit, and the deaeration of the condensate to a point where air content does not exceed 0.03 cc per liter. There are no baffles to cause changes in direction of steam flow.

The photo shows a 27,000-sq. ft. Elliott condenser which is now on duty at an eastern utility. In construction and performance it is typical of the many Elliott condensers serving many power stations and plants.

# CHECK the FACTS




1. Maximum strength, with proper use of restricted materials.
2. Clamping surfaces designed to maintain constant clamping pressure.
3. Can be supplied with class A, B or D insulators, using high strength, all glazed porcelain (class B shown).
4. Hardware attached with resilient alloy in place of cement, eliminating spot loading.
5. R&IE assembly assures uniformity in strength, dimension and appearance.

## R&IE BUS SUPPORTS

*The Check list*

- CONDUCTOR SUPPORT CLAMPS AND FITTIN
- DISCONNECTING SWITCHE INDOOR AND OUTDOOR
- AIR BREAK SWITCHE
- INTERRUPTER SWITCHE
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATIN MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSE
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

LWAY AND INDUSTRIAL ENGINEERING CO., GREENSB RG, PA.

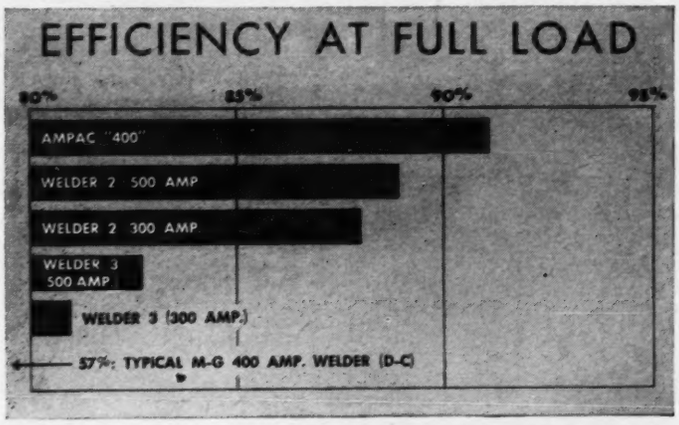
CANADA—EASTERN POWER DEVICES, LIMITED, TO RONTO

# AMPAC "400" GIVES YOU IDEAL SIZE AND RANGE!

**1** Top welder *engineering,* too, is incorporated into every Ampac. This compact reactor coil is efficient . . . cool-operating. Its spun-glass insulation is *flame-proof!*

**2** Ampac gives you *all* a.c. welding advantages — including *no arc blow!* Wide 50-500 amp range provides capacity for *90%* of all welding needs! Simply designed and ruggedly constructed for gruelling wartime service. *Minimum* maintenance required!

**3** Smooth one-inch movement of upper core covers entire welding range . . . in *seven turns* of control wheel. Result: less time for *adjustment* — more time for *production!*



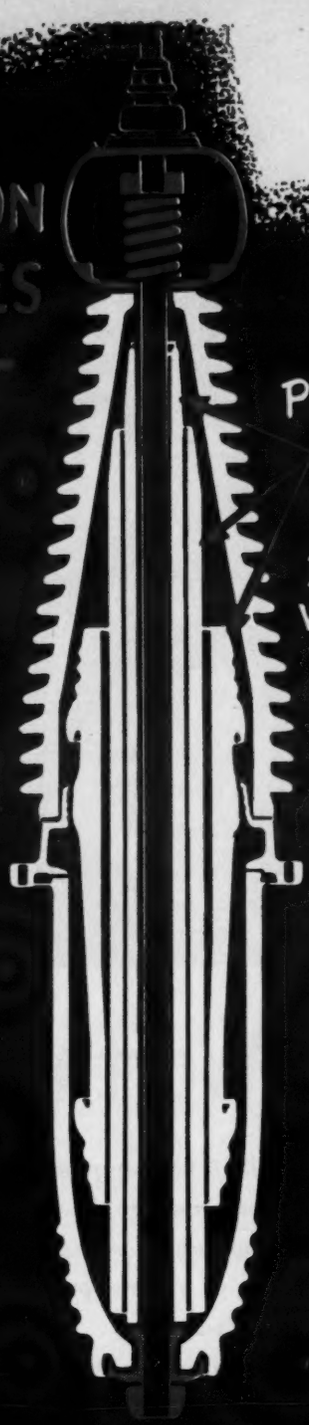

**4** High welder efficiency means *decreased* power consumption — and therefore *lower power bills!* Compare Ampac's excellent rating against two largest selling a.c. welders and a typical d.c. unit. You *save* with Ampac! A 1678

**GET THE FULL STORY** on this great new welder from your nearby Ampac dealer or Allis-Chalmers district office. Learn about its exclusive patented circuit. Ask for bulletin B6302 . . . also B6241 on Ampac "200".

**ALLIS-CHALMERS**

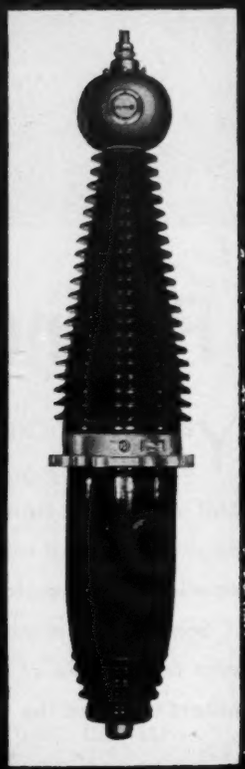
MILWAUKEE, WISCONSIN

A PRACTICAL INSULATION IS PUT WHERE IT DOES THE MOST GOOD—



PORCELAIN INNER SHELLS

DURABILITY WHERE IT COUNTS



BUSHING insulation must be more than just a good dielectric. Two other demands are made upon it: ruggedness to withstand hard service; durability to withstand the passage of time. For this sound reason, O-B bushings are insulated with porcelain, *inside and outside*...Porcelain insulation is not affected by accidental electrical leakage or discharges over its surface. It will never carbonize to form a conductive scar leading to later trouble...Porcelain is totally non-absorbant. It cannot be harmed by the presence of a little moisture...Porcelain is not dependent upon perfect condition of the oil surrounding it...Porcelain is the standard insulation on all power lines for the simple reason that it is completely practical--it will stand a lot of abuse without the need for elaborate protection--and nowhere is porcelain insulation more practical than inside a bushing... ONLY IN O-B BUSHINGS CAN YOU GET INTERNAL PORCELAIN CONSTRUCTION. Specify them on your next requirements.

2468-H

O-B PORCELAIN-INSULATED BUSHINGS

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LTD., NIAGARA FALLS, ONTARIO

# A Partner Worth Having

YES, THE CROCKER-WHEELER field engineer has an ear to the ground and an eye to the future. Not a miracle man, but thoroughly educated in engineering and with years of experience in the application of motors and generators.

Some men on our staff took part in the design and installation of the first steel mill motor . . . others installed the first motors geared to machine tools . . . still others worked on the first motor for printing presses, the first for pumps.

One of our men will be glad to discuss with you any motor or generator problem. While your plans are still in the blueprint stage is the time when his assistance can be most worthwhile. Write, wire or call on us at our nearest office.

**JOSHUA HENDY IRON WORKS**

**CROCKER-WHEELER DIVISION**

ESTABLISHED 1856

AMPERE, NEW JERSEY

CROCKER-WHEELER Motors-Generators

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES

*Crocker-Wheeler Products*

SQUIRREL CAGE MOTORS | WOUND ROTOR MOTORS | DIRECT CURRENT MOTORS | GENERATORS | FLEXIBLE COUPLINGS

# Electric Cables by Simplex

## *for* Power, Communication and Control

**With "synthetic rubber" insulation** which, during the past two years has gradually taken the place of natural rubber compounds. Performance records already promise an important future for Simplex "synthetic rubber" insulation for power, communication and control cables.

*Subject to W.P.B. regulations*

**With varnished cambric insulation** for high voltage over short distances. Particularly suited for station or power house wiring and where operating temperature is high. Varnished cambric insulated cables may be covered with weatherproof or flameproof braids, lead sheath or steel armor.

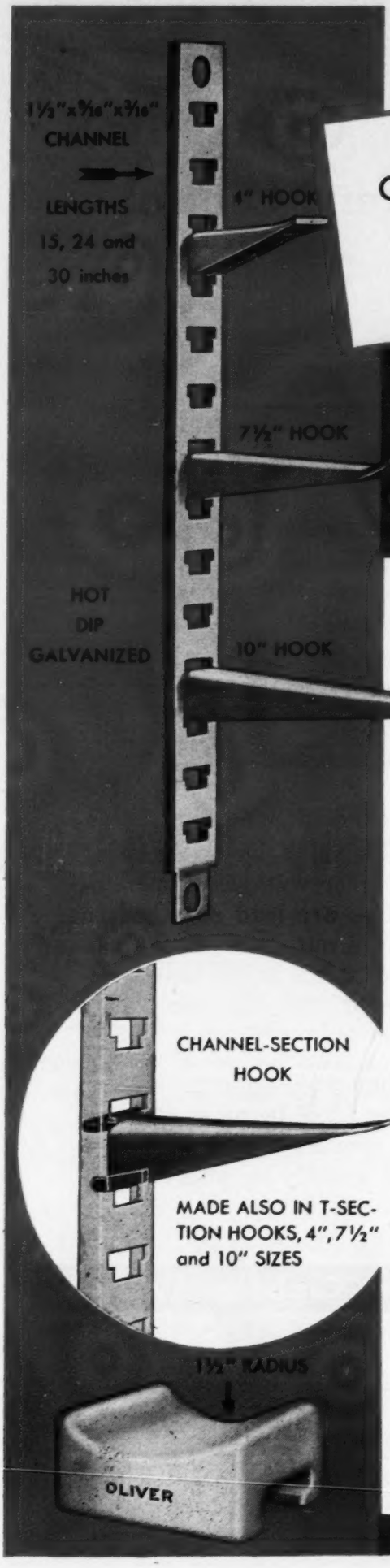
**With impregnated paper insulation** for transmission of large blocks of power at higher voltages. Paper insulated cables are lead sheathed to keep moisture out. Best results can be obtained when cables are specially designed for the work they are to do.

If your postwar plans call for new cables — submarine, underground or aerial — for repairs, replacements or expansion, we shall be pleased to tell you what we can do for you now to help you prepare for the change from war work to "business as usual." It will be greatly to your advantage if you act quickly when the time comes.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex

WIRES and CABLES




*... from the*
COMPLETE LINE OF
**OLIVER**
**LINE MATERIALS**

# OLIVER

## *Underground Cable Racks*

For neat, permanent installations of manhole and interior cable work, use Oliver Underground Cable Racks and other line materials. Oliver Racks are readily installed and easily adjusted to conditions (number of cables, size, spacing, etc.). Standard sizes are designed for telephone and smaller diameter power cables. For heavier cables, use Oliver Heavy Cable Racks and Hooks.

### RACK HOOKS

Two types of Rack Hooks are available, T-Section and Channel-Section. Both fit the standard rack, are easy to install and have rounded edges and wide bearing surfaces to prevent damage to the cable sheath. Channel-Section hooks have extra interlocking lugs to prevent rotation of the hook during installation of cables.

### INSULATORS

For extra protection, Oliver Insulators can be used with either type of hook. Made of white glazed porcelain with a smooth surface and well rounded corners, they prevent damage to sheath due to "creeping" of cable, and provide extra insulation between cable and hooks.

### OTHER ITEMS

The complete line of Oliver Underground Materials includes Anchor Bolts, Duct Shields, Dowell Pins, Pulling-in Irons, Manhole Steps and Ladders. All metal items are made of new rolled steel, hot dip galvanized.

**OLIVER**
IRON AND STEEL
*Corporation*
SOUTH TENTH AND MURIEL STREETS · PITTSBURGH, PENNSYLVANIA

## NOW IS THE TIME TO SELL POSTWAR LOADS

YOUR ELECTRIC COMPANY is interested in postwar loads from industry, from the mining field, from building construction and highway lighting and you will want to know that Roebling is helping to pave the way for you.

Advertising of Roebling Electrical Wires and Cables for 1944 in all of these fields is dedicated to electrical modernization. It is telling industry what electricity can do in cutting postwar costs with better lighting, air conditioning, electrical and electronic control. Reminding the mining and construction fields that electrical modernization can bring them benefits too.

### . . "Your Local Lighting Company's Engineer"

All of this advertising refers its readers directly to the engineers of their local electric companies, for help in planning for fullest postwar use of electricity. We hope that it may help, when the day comes that load-building becomes a problem again.

*Electrical Wire and Cable Division*

JOHN A. ROEBLING'S SONS COMPANY • TRENTON 2, NEW JERSEY

*Branches and Warehouses in Principal Cities*

# ROEBLING

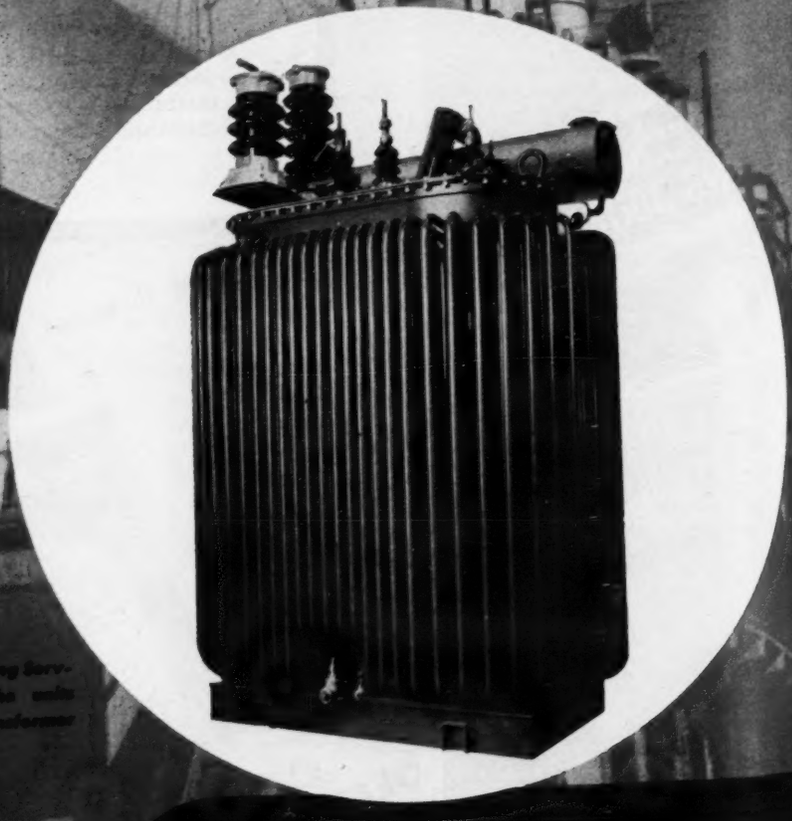
*PACEMAKER IN WIRE PRODUCTS*

WIRE ROPE AND STRAND • FITTINGS • SUSPENSION BRIDGES AND CABLES
HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS • ROUND AND SHAPED WIRE • ELECTRICAL WIRES AND CABLES • COLD ROLLED STRIP
WIRE CLOTH AND NETTING • AIRCORD, SWAGED TERMINALS AND ASSEMBLIES
AERIAL WIRE ROPE SYSTEMS

Highways will "Go Electric"
Tomorrow's Mines will MODERNIZE
How Many EYES on Your Payroll?
How Your Local Utility's Engineer Can Help You Cut Postwar Costs

# ELECTRIC POWER

## FOR BUILDING BATTLESHIPS



THE STANDARD

# OR LIGHTING A FARMHOUSE

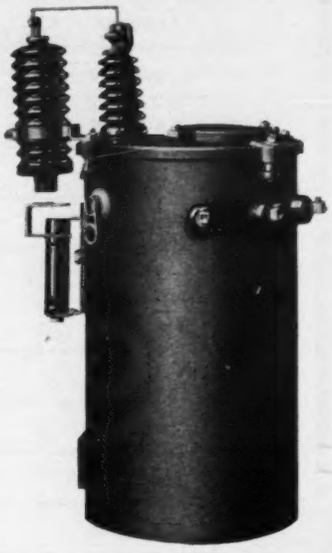
## Delivered "as you want it"

## by Standard TRADE MARK TRANSFORMERS

Forming dependable links in vital electric power supply lines, Standard Transformers are installed the world over—in Navy Yards, Power Stations, Armament Plants . . . and in farm areas.

To help you get electric power "as you want it," Standard offers a complete line of equipment and a staff of experienced engineers backed by a smooth-running manufacturing organization.

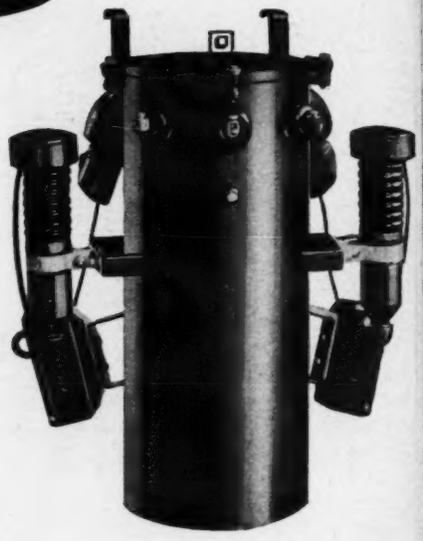
A letter or wire will quickly put the nearest Standard representative in touch with you.



STANDARD type CSP Rural Transformer with low-voltage thermal breaker and high-voltage Deion gap. Completely self-protected against lighting surges, overloads, etc. No fuses to replace.

### ENGINEERED AND BUILT *To meet Your needs*

The flexibility of the Standard Manufacturing process; the experience and resourcefulness of Standard engineers, enables us to design, build and deliver *promptly,* dependable, efficient transformers to meet your needs. From the smallest types to 10,000 KVA. units—liquid or air cooled—individual transformers or unit substations—you can depend on Standard Transformers.



STANDARD type ESP Distribution Transformer equipped with two valve Lightning Arresters and Expulsion Fuse Cutouts. Dependable and economical. Pole or crossarm mounting.

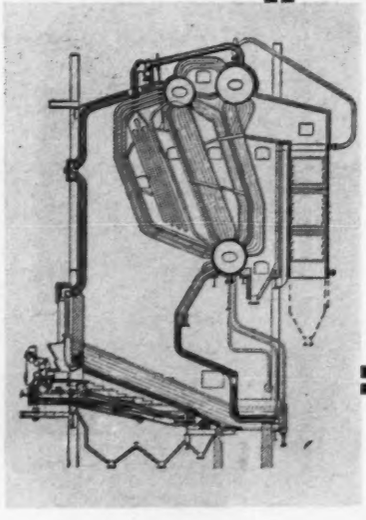
**D TRANSFORMER COMPANY** WARREN, OHIO

# 1943 Installations of
# span the whole range of

## C-E UTILITY UNITS INSTALLED IN 1943

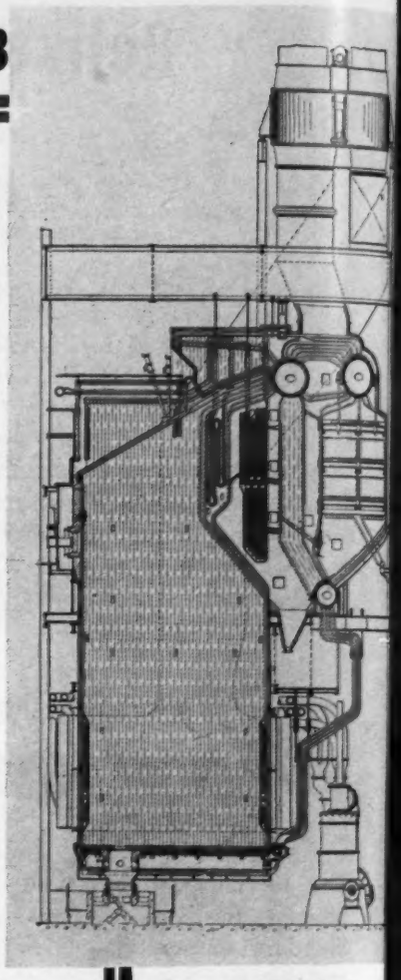
| CAPACITY lb steam per hr | DESIGN PRESS. lb per sq. in. | TOTAL STEAM TEMP degrees F |
|---|---|---|
| 1,000,000 | 1800 | 955 |
| 690,000 | 1390 | 825 |
| 600,000 | 975 | 860 |
| 525,000 | 775 | 900 |
| 440,000 | 975 | 910 |
| 430,000 | 1400 | 895 |
| 425,000 | 975 | 905 |
| 400,000 | 950 | 860 |
| 350,000 | 800 | 830 |
| 340,000 | 1425 | 930 |
| 300,000 | 750 | 835 |
| 150,000 | 750 | 750 |
| 100,000 | 700 | 750 |
| 80,000 | 725 | 848 |
| 80,000 | 725 | 830 |
| 60,000 | 500 | 735 |

Several of the above installations include two or more units.



**80,000**
**lb steam per hr**

This is one of the smaller C-E units installed in a utility plant in 1943. It is fired by a C-E Multiple Retort Stoker and is designed to produce 80,000 lb of steam per hr at 665 psi and 830 total temperature.



**1,000,000**
**lb steam per hr**

This is the largest unit installed in 1943 and the most recent million-pound installation. There are but 10 units of this size in the world and 8 are C-E units. The design pressure is 1800 psi; total steam temperature 955 F.

# COMBUSTION

Canadian Associates: COMBUSTION ENGINEERING CORPORATION LIMITED, Montreal, Toronto, Winnipeg, Vancouver

# C-E Steam Generating Units present-day utility practice

**C-E Units placed in service in utility plants during 1943, as listed at the left, have a total rated output of 7,270,000 lb of steam per hr. They supply a substantial part of the new turbine capacity added by utilities during the past year. In range of capacities, pressures and temperatures and variety of fuels burned, this list of C-E utility installations parallels those for some years past. It therefore serves to emphasize again both the breadth and continuity of Combustion Engineering's experience in the whole field of steam power generation.**

## CAPACITIES

Unit capacities range from 1,000,000 lb of steam per hr, top rated capacity for steam generating units, down to 60,000 lb per hr, certainly in the lowest capacity group for present-day utility practice. Between these extremes there is an exceptionally complete sequence of unit sizes.

## PRESSURES

Design pressures of these units vary from 1800 psi — the highest for the year — to 500 psi, a very moderate pressure in the light of present utility practice. There are 3 installations in the 1390 - 1425 psi category, 4 in 950 - 1000 psi group and 7 which range from 700 to 800 psi.

## TEMPERATURES

Steam temperatures cover a considerable range, from 955 F — the high temperature for the year — to 735 F. Nine installations were designed for temperatures from 800 to 900 F; 4 above 900 F and 3 below 800 F.

## FUELS

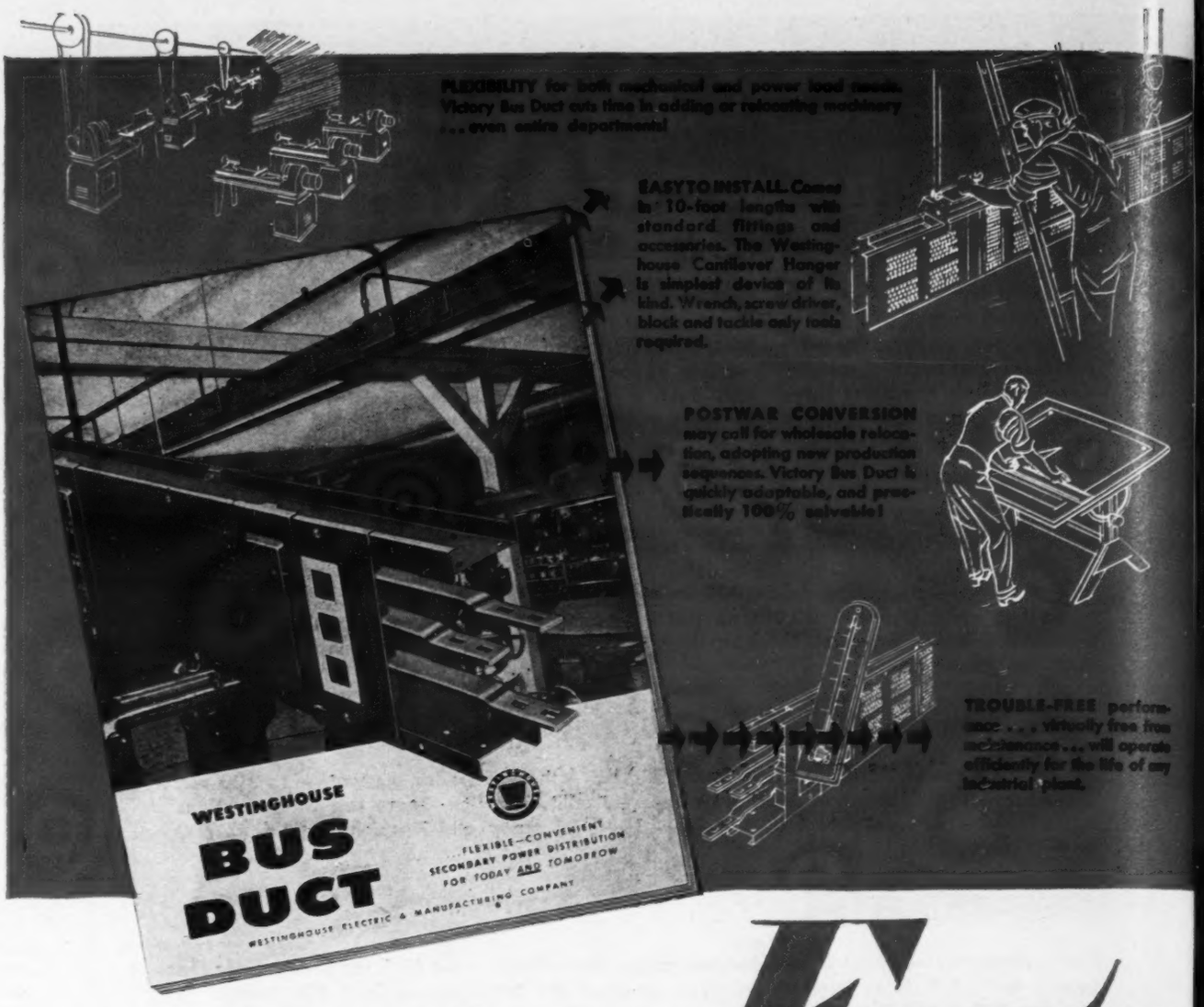
The variety of fuels is suggested by the unusually wide geographical distribution of these installations. They are located in 12 states covering the country from New Hampshire to Louisiana and from Alabama to Wisconsin. Many different fuels are specified — several eastern and western bituminous coals, anthracite, oil and natural and coke oven gas. In some instances only one fuel is specified, others have alternate fuels or two or more fuels used in combination. One installation is among the few in the country burning pulverized anthracite.

**While these installations exemplify the range and extent of our contemporary work for utilities, they are only part of the story. For while these units were being designed, manufactured and installed, Combustion Engineering, as the largest supplier of boilers for U. S. Maritime Commission ships, was also turning out marine boilers by the thousands and land boilers for hundreds of war production plants.**

A-779

# ENGINEERING

200 MADISON AVENUE NEW YORK 16, N. Y.


FLEXIBILITY for both mechanical and power load needs. Victory Bus Duct cuts time in adding or relocating machinery ... even entire departments!
EASY TO INSTALL. Comes in 10-foot lengths with standard fittings and accessories. The Westinghouse Cantilever Hanger is simplest device of its kind. Wrench, screw driver, block and tackle only tools required.
POSTWAR CONVERSION may call for wholesale relocation, adopting new production sequences. Victory Bus Duct is quickly adaptable, and practically 100% salvable!
TROUBLE-FREE performance ... virtually free from maintenance ... will operate efficiently for the life of any industrial plant.
WESTINGHOUSE
BUS DUCT
FLEXIBLE—CONVENIENT SECONDARY POWER DISTRIBUTION FOR TODAY AND TOMORROW
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

## YOU SHOULD HAVE THESE *Facts*

# ...before buying BUS DUCT

Industrial distribution systems must be flexible to meet war's constantly changing demands ::: and must fit readily into post-war conversion plans.

Westinghouse Victory Bus Duct meets both today's and tomorrow's requirements. It has many exclusive features contained in no other type of duct. A few of its outstanding advantages are listed above.

Bus Duct FACTS are contained in Bulletin 3286. This bulletin is a concise ::: complete ::: usable handbook on Bus Duct. It tells why Victory Bus Duct should be used ::: why it meets Limitation Order L-273 ::: why every rating carries complete Underwriters' approval. In addition, it gives data on plug-ins and fittings; dimension data; and specifications.

Ask your Westinghouse representative for a copy or write Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

J-60544

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

BUS DUCT

# HERE'S HOW TO "PUT THE FINGER" ON SLEEVING—

***Tap test proves new BH "extra flex" Fiberglas Sleeving is non-fraying***

HERE's a new sleeving that is *both* flexible and non-fraying. And you can prove it *right at your own desk* with this simple tap test:

Obtain from us a sample of BH Extra Flexible Fiberglas Sleeving equal in size to the saturated sleeving you use now. Hold both types in your left hand, as illustrated, and finger-tap each sleeving 15 to 20 times. BH Extra Flexible Fiberglas Sleeving will spread slightly, may fuzz a little, but it will not fray. The usual saturated sleeving will break down at the edges and separate. Continued manipulation will not noticeably affect the BH Extra Flexible Fiberglas Sleeving, whereas the saturated sleeving will readily unravel and become progressively worse.

**NON-FRAYING • FLEXIBLE • HEAT-RESISTANT**
**NON-INFLAMMABLE • WATER-RESISTANT**
**NON-CRYSTALLIZING at LOW TEMPERATURES**

The new BH Extra Flexible Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes from No. 20 to ⅝", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

***THIS—NOT THIS***

BH PRODUCTS

*NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING*

**BENTLEY, HARRIS MANUFACTURING CO.**
**Conshohocken, Penna.**

*Are you receiving the monthly informative "Gould Battery News"? If not . . . ask for it.*

•

Rated conservatively . . . Goulds equal or exceed in capacity any battery of comparable size and cell structure.

• In the Gould Plante battery the positive plates are blanks of pure lead spun to a finely ribbed cross-section to greatly increase the surface area. Then each plate is electro-chemically treated to create a film of lead peroxide on each side of the plate.

With the surface greatly increased by the ribbing process and then converted to lead peroxide, there is a greater area of active material in contact with the electrolyte than in a battery of ordinary design. This is the reason for the unusually high capacity of the Gould Plante.

This large area of active material remains constant throughout the life of the battery for, as the active surface wears away, the pure lead core is, in turn, converted to lead peroxide by the normal action of the cell. This assures sustained voltage in the Gould Plante.

Get all the facts on the Gould Plante. Ask for Gould Sealed-In-Glass Bulletin, using business letterhead.

**GOULD STORAGE BATTERY CORP.**

DEPEW, N. Y. • Factories at Depew, N. Y. • North Bergen, N. J. Zanesville, O. • Dallas, Texas • Atlanta, Ga. • Chicago, Ill. St. Paul, Minn. • Leavenworth, Kan. • Los Angeles, Cal.

*FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT*

GOULD

*Since 1898* THE BATTERY PICKED BY ENGINEERS


## SELF DISCHARGE

***One of a series of service suggestions for users of industrial batteries.***

◀ Self discharge is the tendency of a battery to lose power during the period when it is not in active service. It is primarily dependent upon the type of plates used, although the purity of the electrolyte can be a contributing factor.

There are two general types of lead cell batteries. In industrial trucks, Diesel starting, automotive and other uses, where the emphasis of design is on light weight, small bulk and high capacity, batteries with pasted plates are almost universal. In the better stationary installations, where neither weight or bulk represents a serious problem, solid lead or Plante type plates are favored.

With the latter type, particularly when the positive plates are made entirely of pure lead, as in the Gould Plante, self discharge is not an important matter. However, in pasted plate batteries which employ grid frameworks to hold the active material in place, it becomes a serious problem. This is especially true if the battery must stand idle for any great length of time.

Antimony is the secondary metal commonly alloyed with lead to give grids the necessary strength to hold active material in place. During charging operations, a small amount of this antimony usually dissolves from the positives and is plated on the sponge lead of the negatives. There it sets up a local action that causes the plates to discharge slowly.

All lead batteries will discharge when standing idle. They discharge faster when warm than cold and this loss is greater in an old battery than in a new one. This discharge on a good, fully-charged unit approximates the following specific gravity readings:

at 100° F.—.003 S.G. per day
at 80° F.—.002 S.G. per day
at 50° F.—.0005 S.G. per day

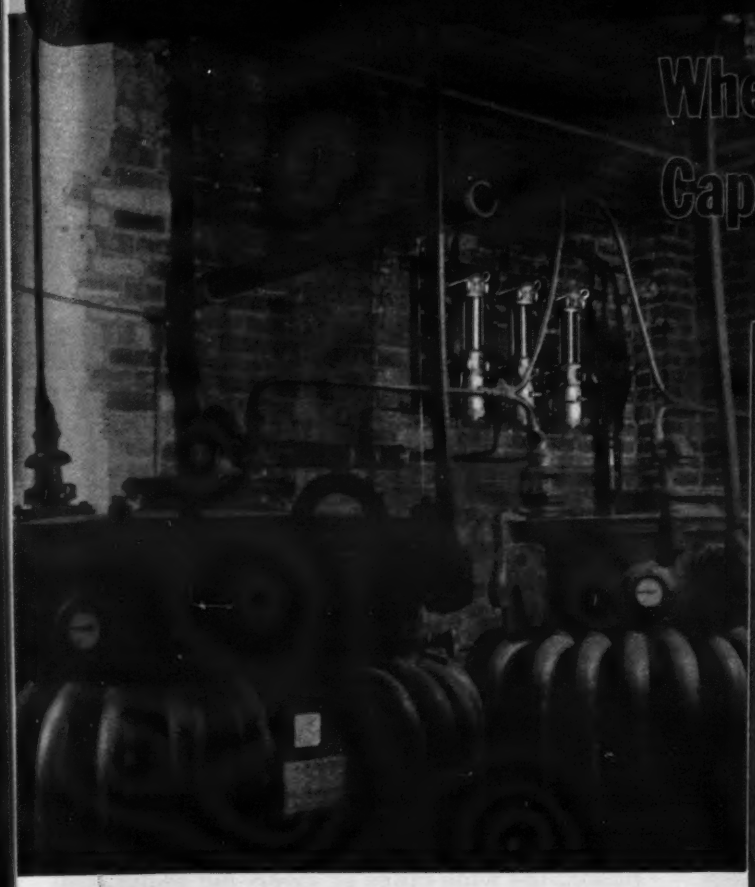
If self discharge materially exceeds these rates a Gould service man should be called in.

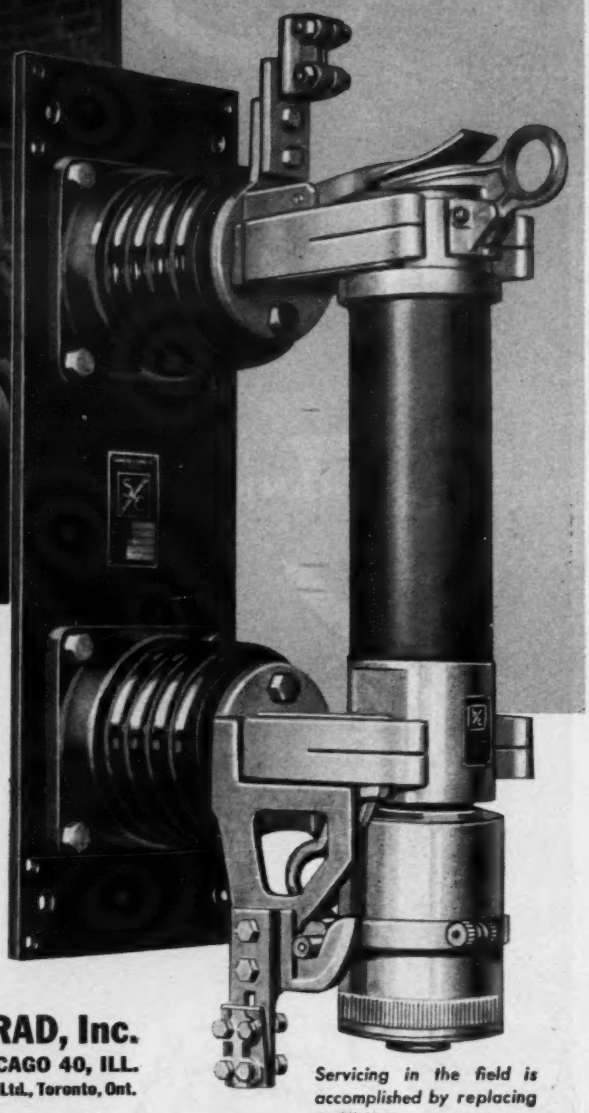
Normally, self discharge is not important to battery users who cycle their equipment frequently. However, it represents a big factor when selecting a battery for floating installations. The Gould Plante is preferred for this service by many engineers because its positive plates are of one-piece pure lead construction, that contains no antimony.

*(Advertisement)*

# SIMPLIFIED PROTECTION

## Where High Interrupting Capacity Is Needed • •





● High interrupting capacity S & C Type "SM" Fuses provide dependable power system protection, but require only a small amount of space. They are compact and comparatively light in weight and therefore present no installation problem.

Because they are so easily serviced in a few minutes, unnecessary delays serious to production are avoided.

S & C Type "SM" Power Fuses have short-circuit interrupting ratings up to 1,000,000 KVA in capacities from 1 to 400 amperes, making for wide application both indoor and outdoor for systems up to 33,000 volts.

S & C Fuses afford appreciable savings in initial and maintenance costs.

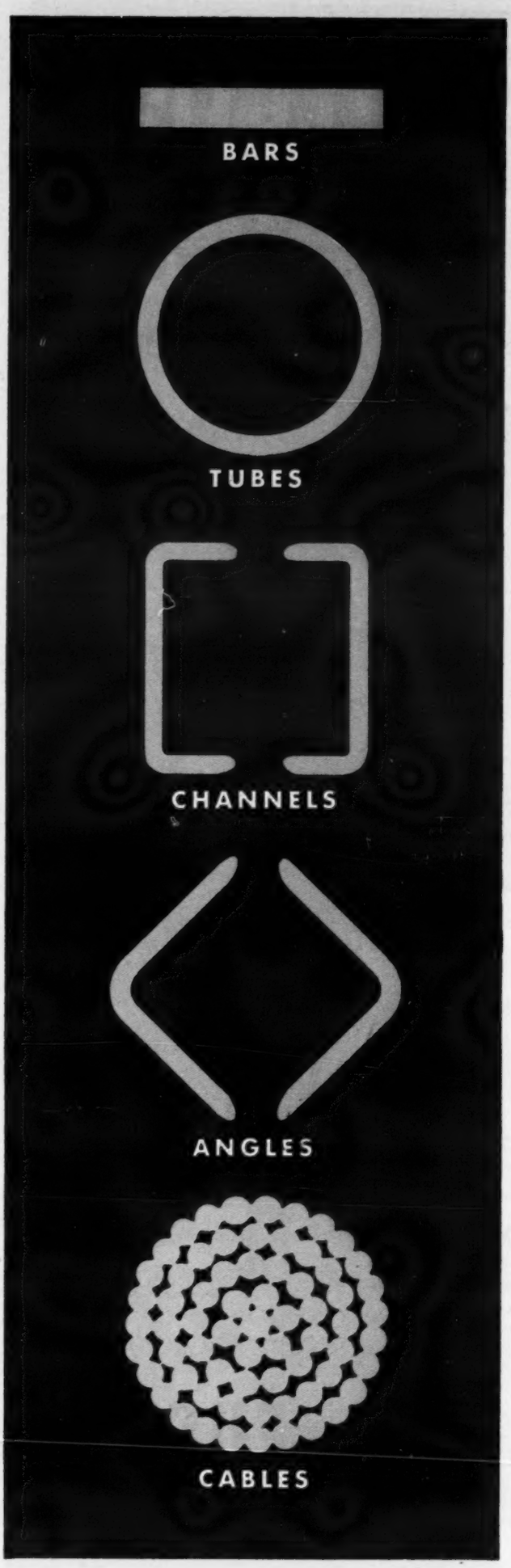
Simplify your protection problems with S & C Fuses. Write for Bulletin 200-E.

**SCHWEITZER & CONRAD, Inc.**
**4435 RAVENSWOOD AVE. • CHICAGO 40, ILL.**
**Supplied in Canada through Powerlite Devices, Ltd., Toronto, Ont.**

*Servicing in the field is accomplished by replacing Refill Unit.*

## TYPE "SM" POWER FUSES

***Experience Will Choose the S & C Fuse***




# Copper Bus Shapes FOR EVERY REQUIREMENT

Because of its high conductivity and consequent low current losses, copper has always been the most widely used material for bus conductors.

To these advantages may be added such further qualifications as high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment. Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the wide range of *copper bus shapes made by The American Brass Company will meet every requirement.*

In addition to a complete line of copper bus bars of rectangular shapes, this Company makes high conductivity pipe and tube, stranded cables and many special shapes.

Of particular interest to electrical engineers are the ventilated busses made from channels, angles, tubes and rectangular copper bars. Information, including our Bus Conductor Booklet, C-25, and the suggestions of our Technical Department on various bus conductors and assemblies, is available on request. 44109

ANACONDA

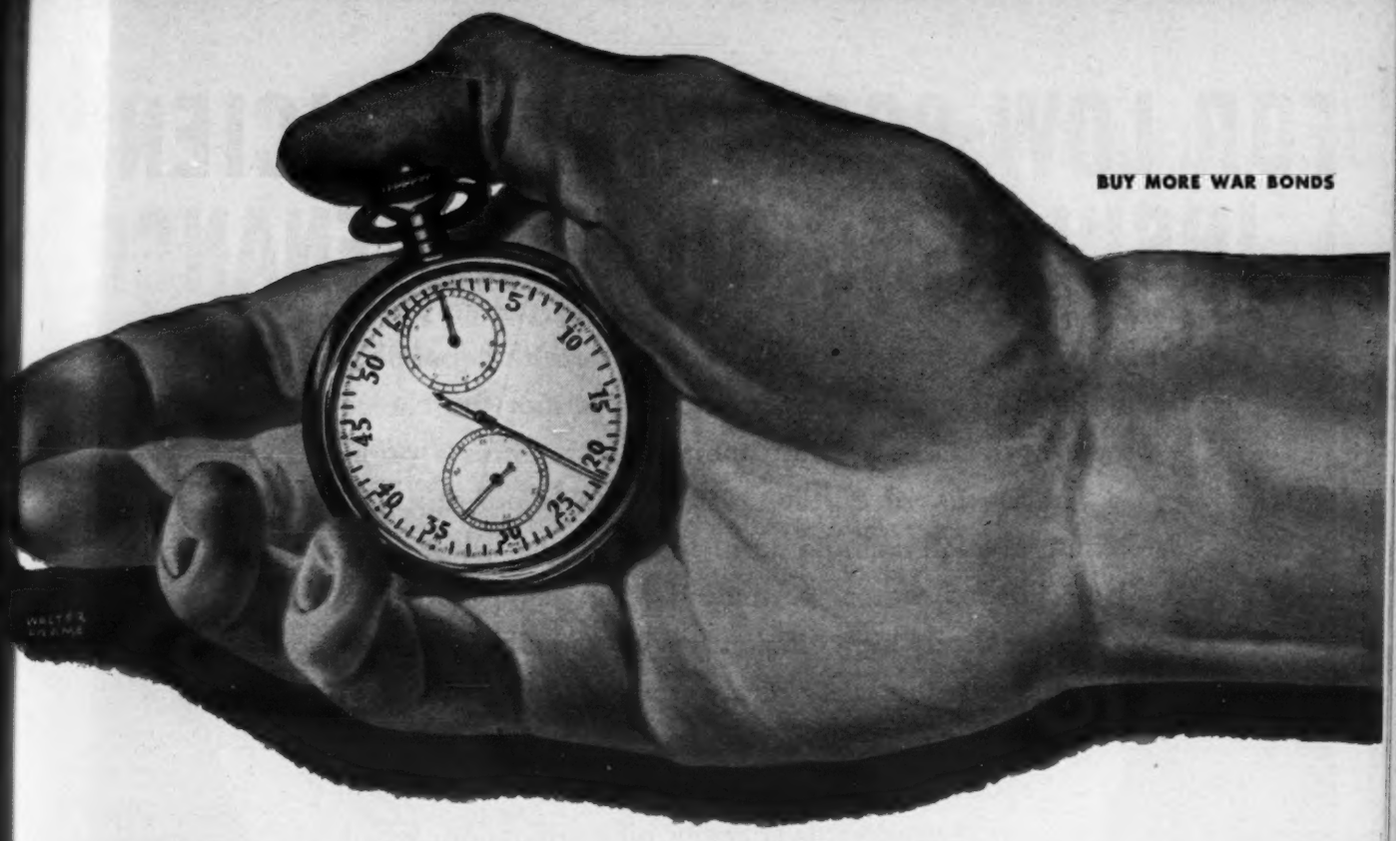
Anaconda Copper

THE AMERICAN BRASS COMPANY

*Subsidiary of Anaconda Copper Mining Company*

General Offices: Waterbury 88, Connecticut

*In Canada:* ANACONDA AMERICAN BRASS, LTD., *New Toronto, Ont.*



BUY MORE WAR BONDS

# How to use an RCA Electron Tube for a Stop Watch

UPPOSE your job depended on the accuracy with which you could—by watching a clock—time an operation that must vary one half-second either way. How you think your clock-watching eyes ld feel, and what would your fatigue ve show, as the day wore on?

f electronic timers—and the electron es that make them work—did no more n free human beings from such nerve ain, they would rank high on the indus- l front. But they do far more than that. r instance—

Here at RCA, we must carefully clean many small parts that go into every e we build. Otherwise the tube's permance may be faulty at final test and tube must therefore be rejected, result- in a loss of valuable time, materials, d facilities. One of the cleaning operations involves heating the parts by radio frequency currents which must be very closely time-controlled. It used to require a trained girl, timing herself by a clock, to operate the controls by hand. Now, two electronic timing circuits do the "dirty work" instead. Result: the automatic timing control is far more accurate and uniform than was possible by manual methods; production is faster and of better quality, so that fewer tube rejects occur; and the trained girl who used to operate the controls can now be used elsewhere to contribute to increased production.

The electronic timers for this operation were built by us for our use. While they are not currently available for sale, RCA engineers will gladly recommend electron tubes around which *your* engineers can build electronic timers that may greatly improve the accuracy and efficiency of your critical timing operations.

***The magic brain of all electronic devices is a tube . . . and the fountainhead of modern tube development is RCA.***

For a fascinating free booklet, *Electrons in Action at RCA*, write Room 472, RCA Victor Division, RADIO CORPORATION OF AMERICA, Camden, N. J.

The RCA vacuum firing control uses two circuits to time the "on" and "off" periods. Each period can be controlled in 10 steps by separate dials over a range of ½ to 20 seconds. Duration of "off" and "on" periods is easily changed in processing parts of different sizes. Electronic timing controls can benefit many industries in replacing manual control of cyclic operations.

RCA

RADIO CORPORATION OF AMERICA

# FOR LOW-COST, HIGH-EFFICIENCY INSULATING OIL MAINTENANCE

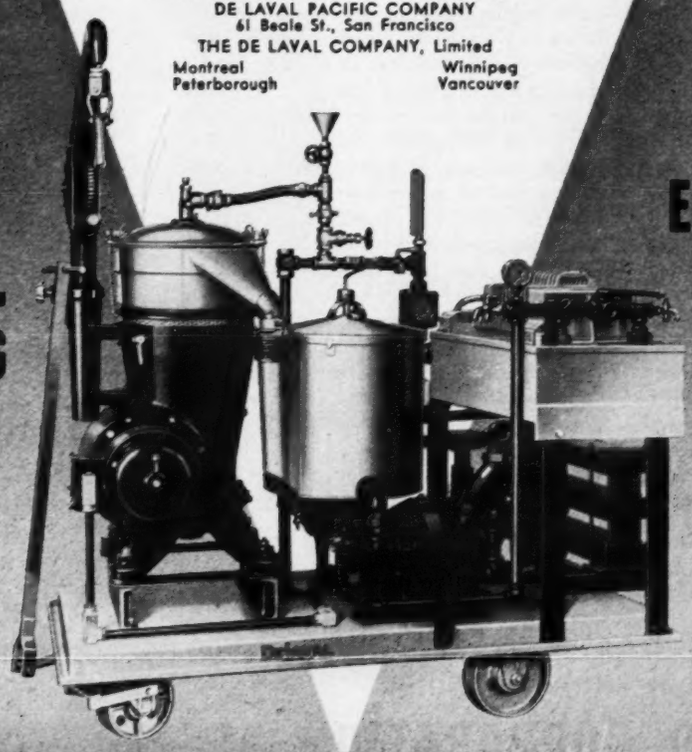
SPEED and economy of operation combine with dependability of results to make the De Laval Insulating Oil Purifier the choice of leading power systems in meeting their oil maintenance problems.

The De Laval Purifier restores the required high dielectric value of oil in a single pass, eliminating re-runs; continuously discharges water, permitting long, continuous operation at uniformly high efficiency with a minimum of attention. As a result, the yearly cost of dehydrating oil in transformers and circuit breakers can be much reduced.

Speedier, less costly oil purification, which is at the same time more positive, leads naturally to improving the average dielectric value of oil in all units, thus contributing directly to dependable sub-station performance.

**THE DE LAVAL SEPARATOR COMPANY**
165 Broadway, New York — 427 Randolph St., Chicago
DE LAVAL PACIFIC COMPANY
61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal, Peterborough — Winnipeg, Vancouver

**THE DE LAVAL INSULATING OIL PURIFIER**



**ECONOMICALLY PROTECTS OIL-INSULATED EQUIPMENT**

# MULTIPLY LIMITED MANPOWER WITH FOUR-WHEEL-DRIVE *Hauling Power*

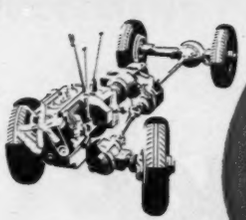
**FWD TRUCKS HELP TO MAKE THE MOST OF AVAILABLE MANPOWER**

When there's a bigger job to do—and fewer skilled men to do it—the performance of equipment assumes added importance. In maintaining vital power and communication lines, which are the nation's nerve system, more than 150 public utilities depend on FWD trucks, because FWD's enable line crews to do more work — faster. In any kind of going on and off the highway FWD's keep rolling, with least trouble and cost per mile. The full power grip of four driving wheels means better traction, and less strain on the chassis. That's one of many reasons why FWD's cover more ground and enable fewer men to get more work done.

**THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wisconsin**

*Canadian Factory: KITCHENER, ONTARIO*

*The True Four-Wheel-Drive Principle With Center Differential Asks Less in Gas • Oil • Tires • Replacements.*

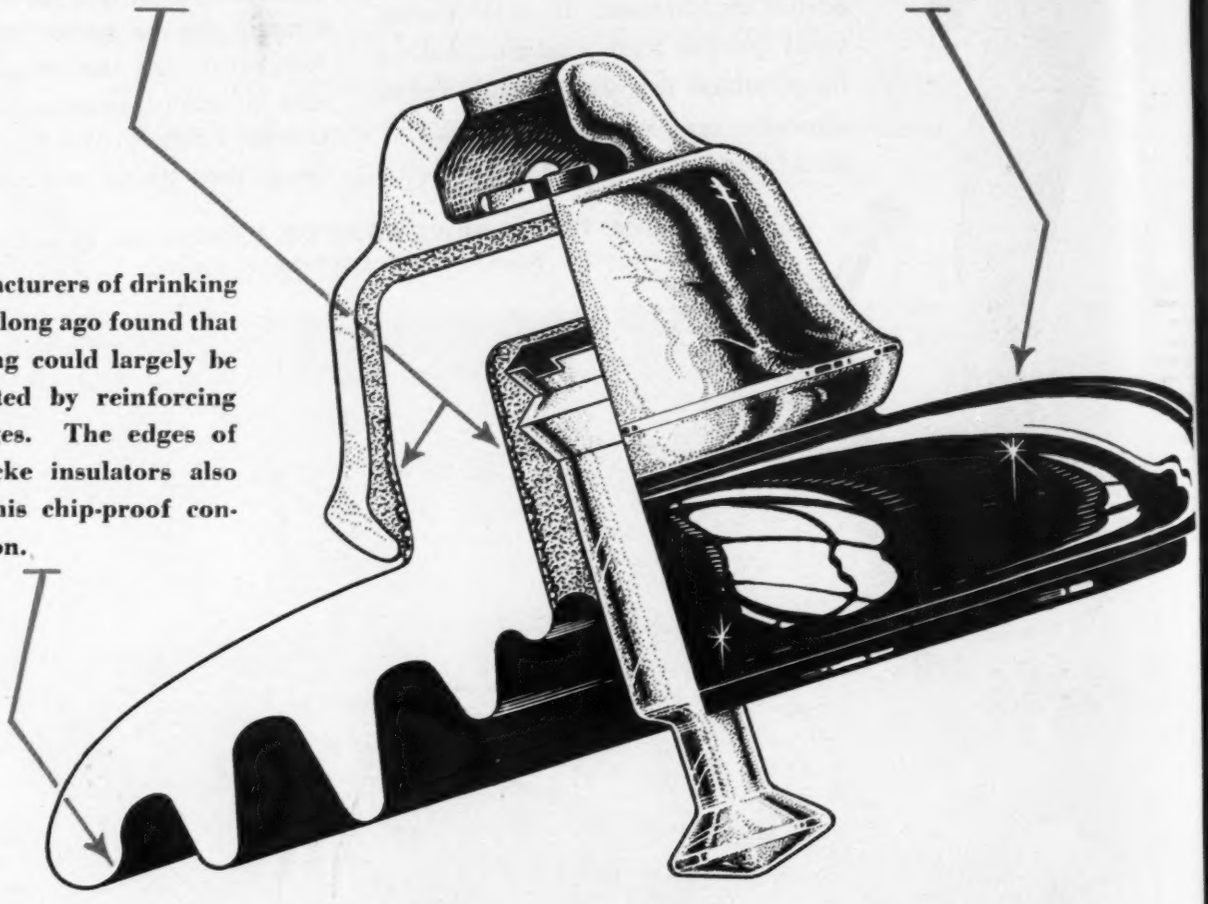


FWD TRUCKS

# Greater Strength at

Even compression glazed insulators can be materially weakened when these surfaces are treated with ordinary "sands". Locke compression sand, on the contrary, makes these working zones the strongest part of the assembly.

The entire surface of every Locke insulator is in compression. Before the initial crack which causes breakage can occur the additional compression strength must be overcome.



Manufacturers of drinking glasses long ago found that chipping could largely be prevented by reinforcing all edges. The edges of all Locke insulators also have this chip-proof construction.

## These Proved Benefits . . .

reduce upkeep—spread the initial costs of your insulators over more years—and enable your construction crews to handle installation and replacements faster and with greater safety.

ORIGINATOR AND LARGEST MANUFACTURER OF WET-PROCESS PORCELAIN INSULATORS

# LOCKE INSULATOR

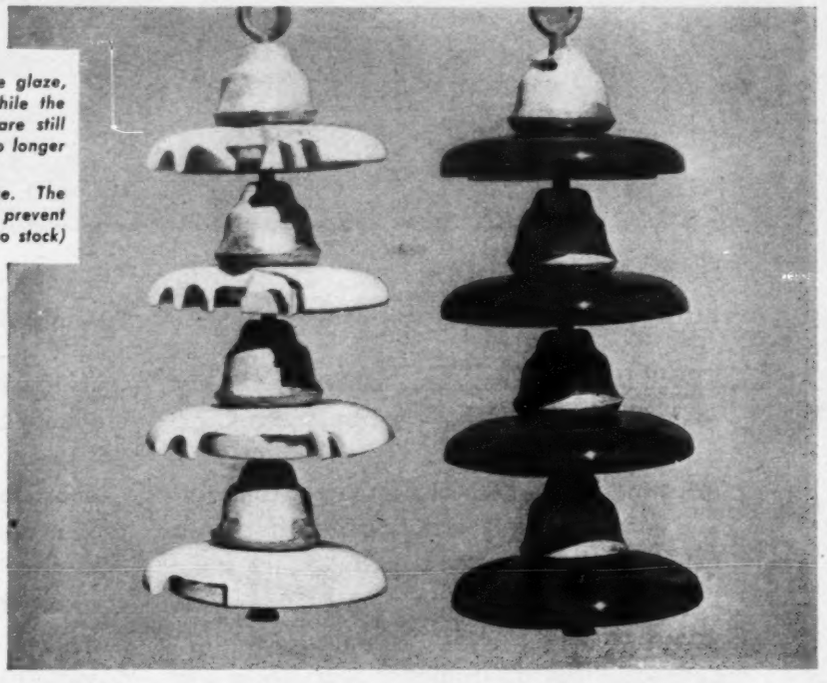
FIRST IN CLAYRAMICS

# All Critical Points

## Keeps Insulator Costs Down To A Minimum . . .

**Thousands of operating engineers have seen the remarkable immunity to breakage of Locke insulators and thousands have proved it for themselves in service.**

**The increased factor of safety which these improvements assure you may easily be the margin between continuous operation and costly service interruptions.**



*These insulators, identical in every respect except the glaze, were subjected to the same mechanical impact. While the Locke Compression Glazed insulators on the right are still intact, those on the left, with ordinary glazing, are no longer fit for service.*

*(Color has no influence on the strength of the glaze. The weaker insulators were deliberately glazed white to prevent any possibility of such a unit accidentally getting into stock)*

### All Locke Insulators

**are compression glazed and reinforced against chipping. In addition all Locke assembled insulators—or insulators furnished for assembly—are standard with Locke compression sand. These developments of the Locke Ceramic Laboratories are responsible for:**

- **LONGER LIFE IN SERVICE**
- **MORE UNIFORM STRENGTH**
- **LOWER MAINTENANCE AND REPLACEMENT COSTS**
- **HIGH FACTORS OF SAFETY**
- **GREATER STABILITY**

FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

# CORPORATION BALTIMORE MARYLAND

FIRST IN CLAYRAMICS

# PERMANENT MAGNETS MAY DO IT BETTER

## Destroyer Escort Kills Subs with Aid of 225 Permanent Magnets

THE U. S. S. Spangler, a Destroyer Escort built by the Defoe Shipbuilding Company, is illustrative of the constantly increasing uses for which permanent magnets are employed. About two hundred and twenty-five permanent magnets are used in this "floating precision instrument" as vital parts of telephone, audio, radio and sub-detection equipment, compasses and other instruments as well as many other electrical and electronic devices.

Permanent magnets perform a similarly wide variety of tasks *throughout* the great panorama of Allied war equipment. And because of our 34 years of specialization in their development and manufacture, our organization has played an important role in designing and providing permanent magnets for many types of weapons and war machines.

This unusual experience should prove invaluable in solving your problems... and our engineers will be pleased to consult with you. Write us on your letterhead, for the address of our office nearest you and a copy of our "Permanent Magnet Manual."

**Help Win the War in '44—**
**Buy War Bonds!**

Copyright 1944—The Indiana Steel Products Co.

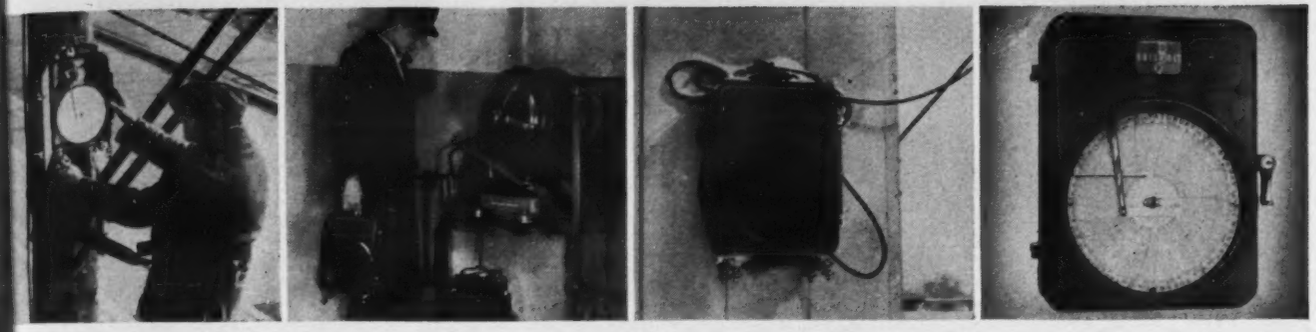
*The*
**INDIANA STEEL PRODUCTS**
*Company*

★ SPECIALISTS IN PERMANENT MAGNETS SINCE 1910 ★

6 NORTH MICHIGAN AVENUE • CHICAGO 2, ILLINOIS

# ALL-PURPOSE PORTABLE RECORDERS

***will help you keep a finger on voltage***



Your men can mount a Bristol All-Purpose ortable Voltmeter on a pole . . . carry it into a llar or down a manhole . . . set it on a floor or ble . . . or mount it outdoors on a building. It's ht and easy to carry . . . has a weatherproof se . . . and is rugged enough to take the wear d tear of constant handling without any interence with accuracy.

*Features:* 17 lbs. . . . replaceable measuring elent . . . pen arm pivoted at top, pen pressure avity-controlled . . . fine bore platinum tip founin pen . . . integral resistors.

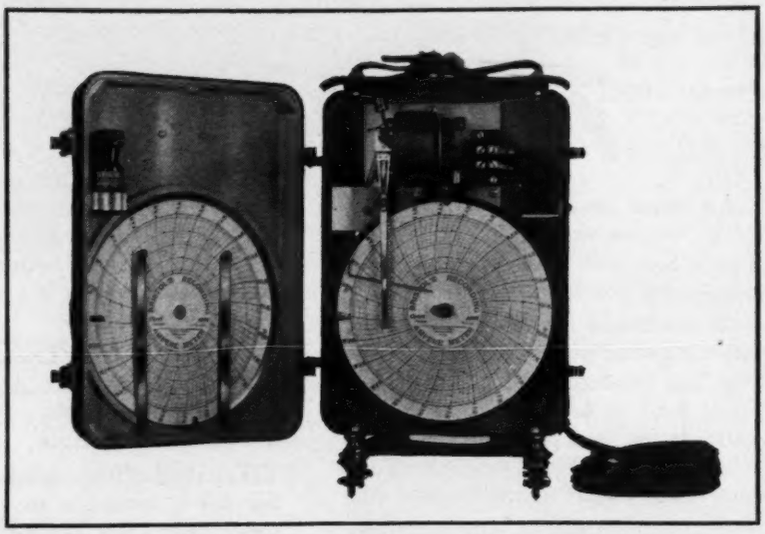
*Complete information in Bulletin E1100.*

## THREE MODELS

**One-Pen** Inexpensive voltmeter for quickly alyzing conditions, investigating complaints, king voltage surveys, general testing, etc.

**Two-Pen** Records two different voltages simulcously on one chart. Used for checking balance three-wire systems and to study voltage drop section of a circuit.

**Three-Pen** Records three different voltages sitaneously on one chart. Used for investigating ditions in polyphase networks, for determining tages at load centers and at ends of feeders.



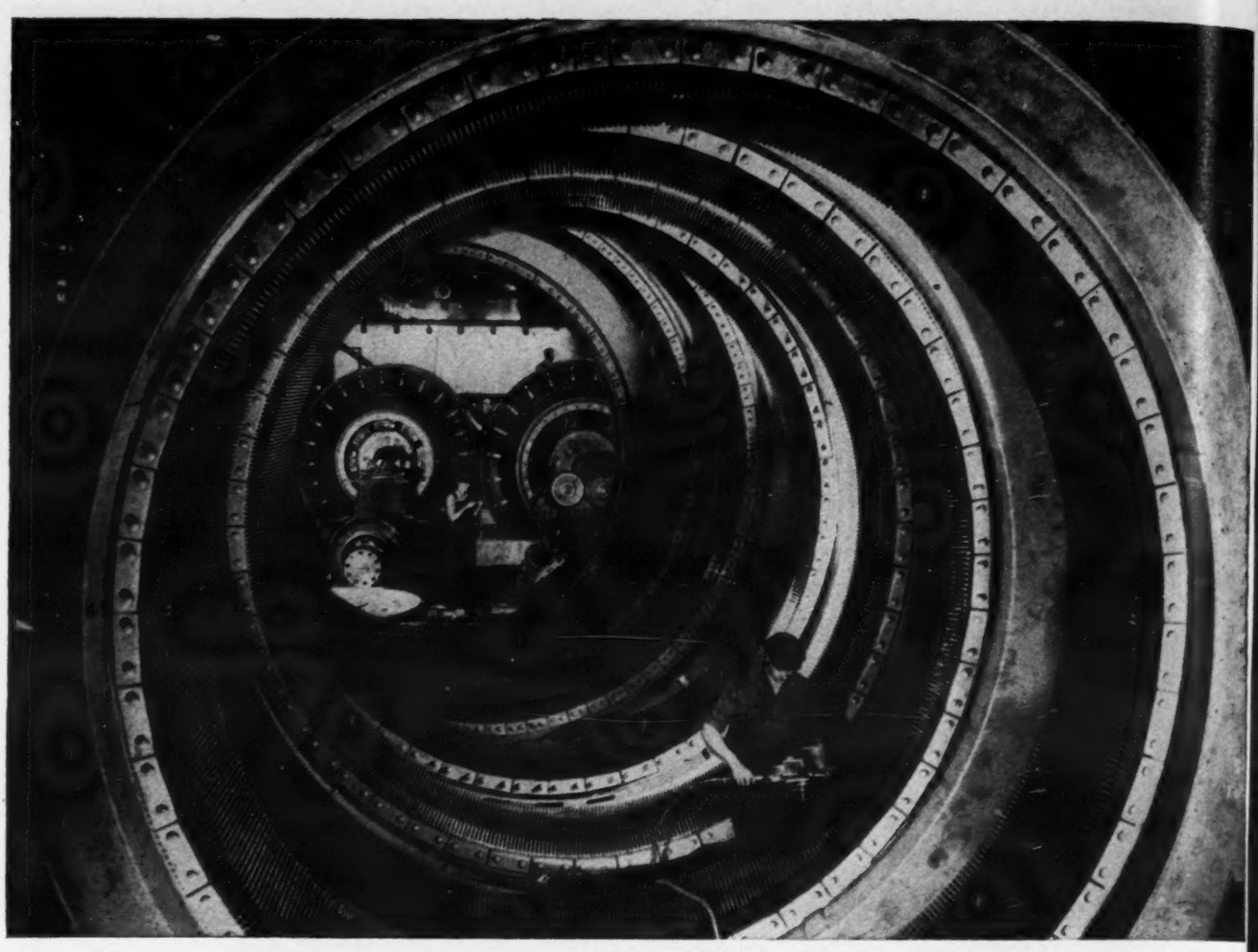
## THE BRISTOL COMPANY, 116 Bristol Road
**WATERBURY 91, CONN.**

The Bristol Co. of Canada, Ltd.
Toronto, Ontario

Bristol's Instrument Co., Ltd.
London N.W. 10, England

***MAKERS OF***

Metameters, Recording Voltmeters, Ammeters, Wattmeters, Thermoverters, and a broad line of Automatic Controlling and Recording Instruments.



# Framing 54,000 hp.

As these seven large slow-speed motors are placed in service, Uncle Sam will have an additional 54,000 hp. for his war effort.

The wartime use of motors of all sizes, together with heating and lighting, has produced the greatest electrical load in history. As an aid in carrying the load, power plants everywhere are lubricating Diesels, turbines and steam engines with Texaco.

In steam turbines, for example, *Texaco Regal Oils (R & O)* keep lubricating systems clean, bearing temperatures normal, governor action smooth and sensitive. They free themselves rapidly from air and water, and are highly resistant to gum formation and sludging. *They are rust and oxidation inhibited.*

So effective have Texaco lubricants proved that they are definitely preferred in many fields, a few of which are listed at the right.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

## THEY PREFER TEXACO

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

TEXACO

# TEXACO Regal Oils

## FOR ALL TURBINES

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

# QUICKLY ISOLATE *cable circuits with*

## G & W TYPE "RA" OIL SWITCHES

SEND FOR NEW BUL. No. 743

TYPE "RAL" →
(3 way with 2 sets of links and tie bus.)

No covers to remove.

No seals to be broken.

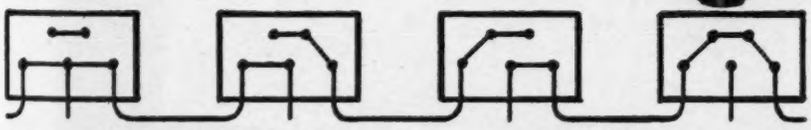
No links to unbolt.

Oil filled tanks keep size to minimum — operating shafts perfectly sealed.

Simple and safe sectionalization by merely operating external lever arms.

Voltage ratings —600, 7500, 15000 (shown), 23000 and 34500 ——

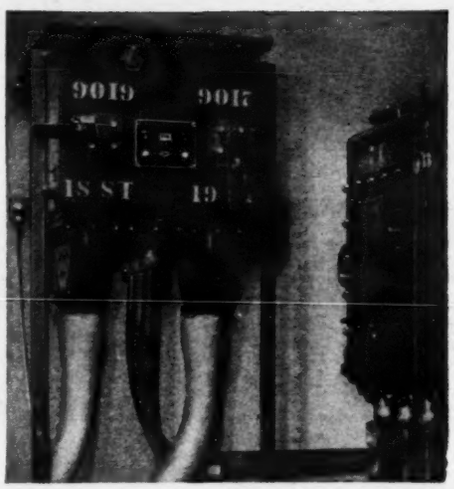
Ampere ratings —400 (standard), 1000 and higher (special designs)



### FOUR CONNECTIONS WITH ONLY TWO SETS OF LINKS

Type "RAL" three way switch, with two sets of gang-operated links and one set of tie busses, makes an ideal unit for use on loop systems.

It permits the loop to feed through with or without the branch connected, also to feed the branch from either side with the other side disconnected. Thus, any section of the loop can be isolated and any branch can be disconnected without affecting the continuity of the loop. This situation formerly required the use of three separate oil switches, involving a greater expense not only of the switches but also in the additional manhole or vault space necessary.




*Send for new bulletin No. 743*

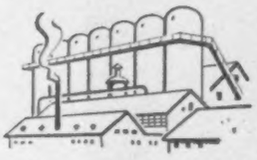
**G&W ELECTRIC SPECIALTY CO.**

*Cable Terminating, Sectionalizing and Protecting Equipment*

7780 DANTE AVENUE, CHICAGO 19, ILLINOIS, U.S.A.

Also made in Canada by Powerlite Devices, Ltd., Toronto

# MECHANICAL GUARDIANS FOR CHEMICAL PIPE-LINES



In chemical industries, synthetic rubber plants, oil refineries... any plant, piping precious or potentially hazardous fluids... a mistake, whether unintentional or deliberate, in adjusting a chemical pipe-line valve can prove both dangerous and costly. But prevention of these human errors is easy and infallible with BENDIX-CORY* SAFETY INTERLOCKS... the locks that say "No!" to unauthorized handling of your valves.

The BENDIX-CORY SAFETY INTERLOCK illustrated gives absolute control over the opening and closing of the valve to which it is attached... and, by use of an interlock key, can also control the position of this valve in relation to any number of other valves. The unit is wholly mechanical, and fully adjustable to compensate for valve wear —one of a number of interlocks specially designed for valve protection.

As safety men of the Bendix "Invisible Crew," BENDIX-CORY SAFETY INTERLOCKS are dependable guardians for your pipe-lines. Write for full information.

## CHECK THESE FEATURES

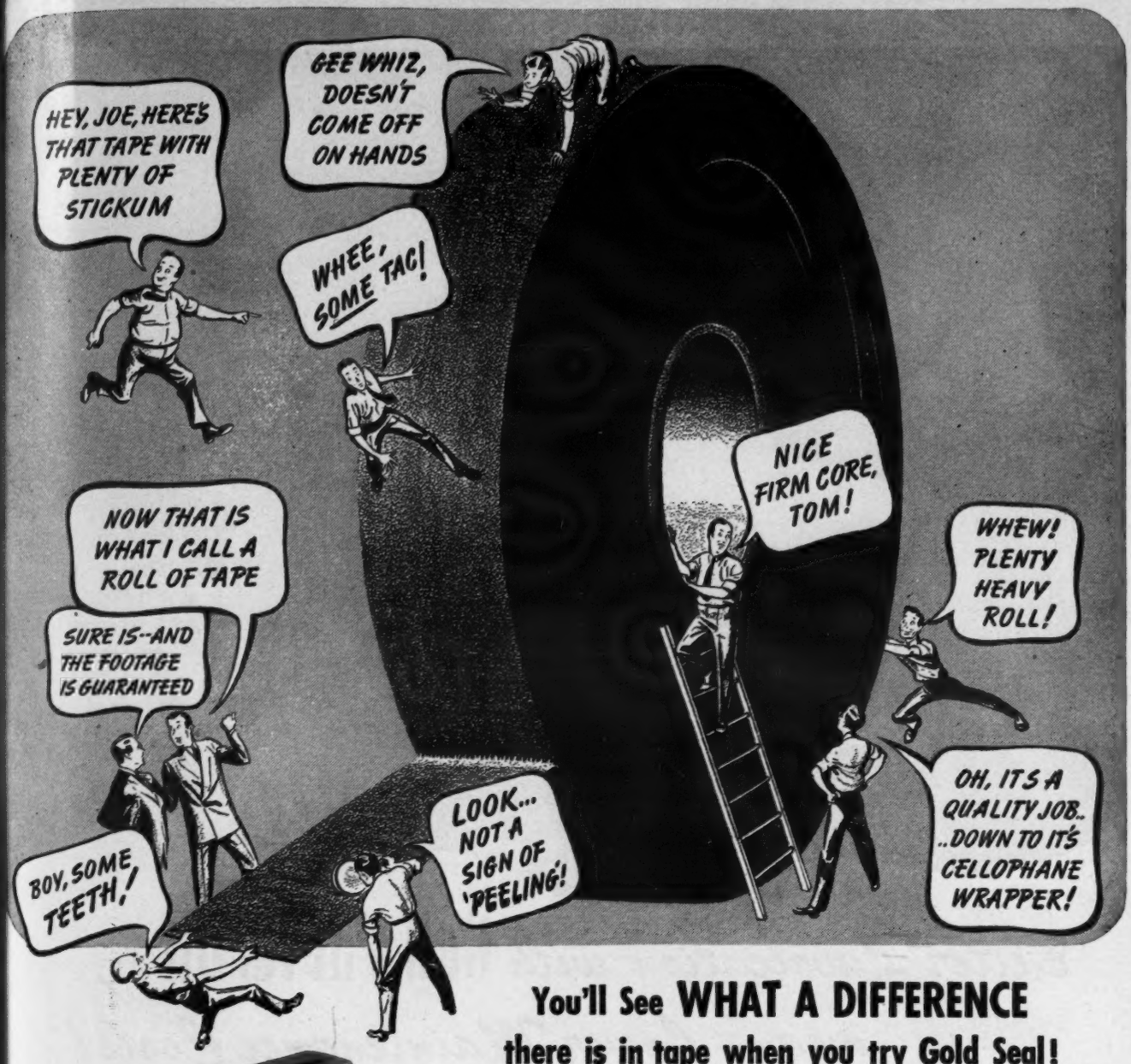
- Interlocks stem valves 2" to 8". Other interlocks for globe, lead and porcelain valves.
- Absolute control of valve opening and closing under all conditions.
- Positions valve in relation to other valves.
- Ample strength characteristics.
- Indoor or outdoor installation without removing valve from service.
- Fully mechanical. No electric circuit.
- Position indicator (not shown) shows valve open or closed.
- Adjustable compensation for valve wear.

*TRADE MARK OF BENDIX AVIATION CORPORATION

Products of this division are members of "The Invisible Crew"—precision equipment which 30 Bendix plants from coast to coast are speeding to our fighting crews on world battle fronts.

THE INVISIBLE CREW
Precision Equipment by
Bendix Aviation Corporation

**BENDIX MARINE DIVISION** • One Hanson Place, Brooklyn, New York


HEY, JOE, HERE'S THAT TAPE WITH PLENTY OF STICKUM
GEE WHIZ, DOESN'T COME OFF ON HANDS
WHEE, SOME TAC!
NICE FIRM CORE, TOM!
WHEW! PLENTY HEAVY ROLL!
NOW THAT IS WHAT I CALL A ROLL OF TAPE
SURE IS--AND THE FOOTAGE IS GUARANTEED
OH, IT'S A QUALITY JOB.. ..DOWN TO IT'S CELLOPHANE WRAPPER!
LOOK... NOT A SIGN OF 'PEELING'!
BOY, SOME TEETH!

## You'll See WHAT A DIFFERENCE there is in tape when you try Gold Seal!

There are "tricks to every trade" – and we believe we use a few that other tape makers haven't heard about. Some of them cost a bit more to put into the product . . . others are "secrets". But – if you could see us make Jenkins Gold Seal Friction Tape, you'd know instantly why this tape gives a tighter, longer-lasting bond . . . why it speeds up work . . . why it doesn't ravel, "peel" and "dry out" like ordinary tape.

A good example of Gold Seal superiority is furnished by the "unwinding test": The Specification Test restricts the pull down rate to 25 inches per minute, but Jenkins Gold Seal Friction Tape cuts that rate in half!

There are other tests just as convincing – but the best proof of all is the "on the job" test you can make yourself! Jenkins Bros. (Rubber Div.), 80 White Street, New York 13, N. Y.; Bridgeport; Atlanta; Boston; Philadelphia; Chicago.

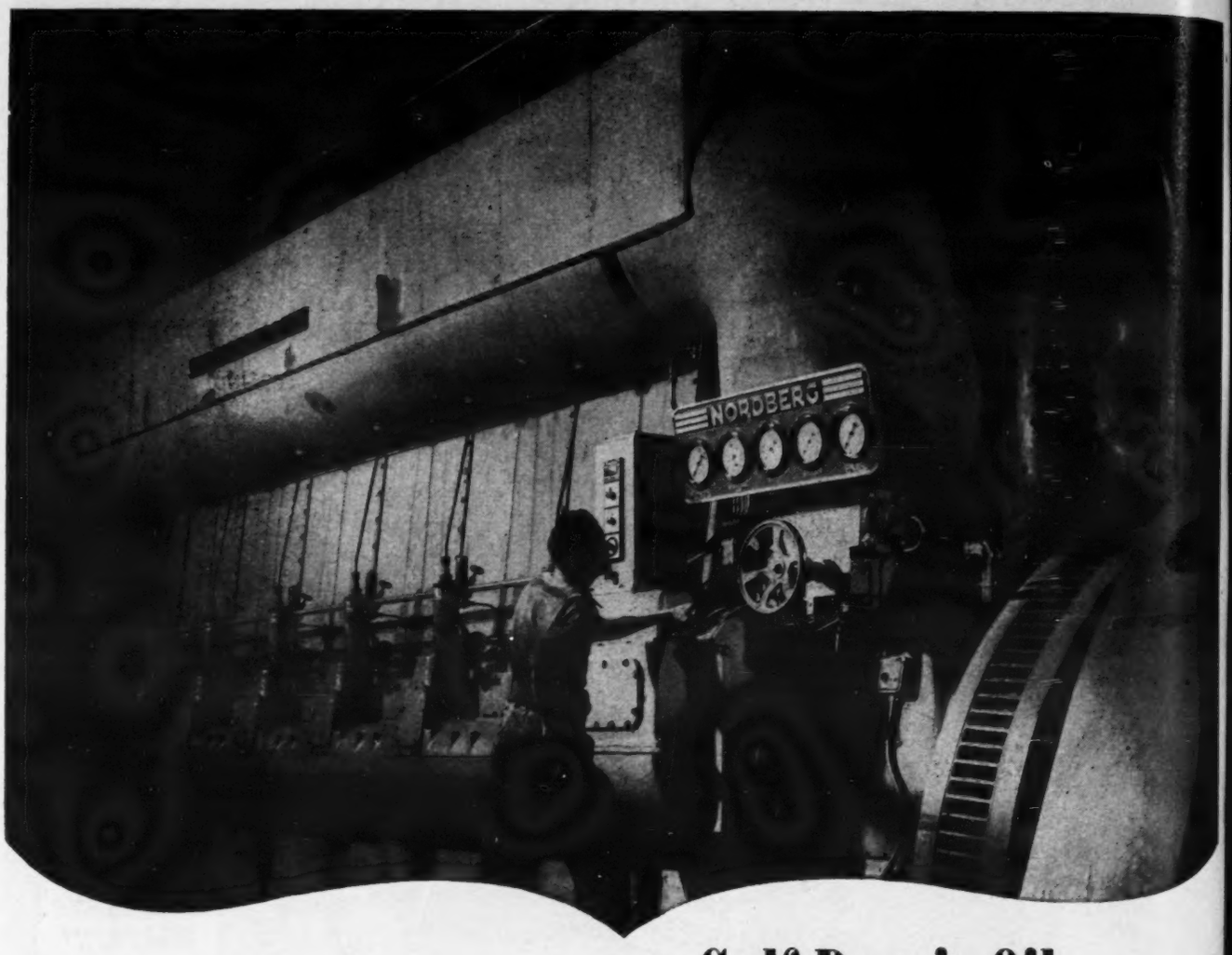
*Other Jenkins Bros. tape products include Diamond Seal Friction Tape, and Diamond Seal Splicing Compound, which meet all ASTM and Federal specifications.*

JENKINS

# Gold Seal Tape

FRICTION and RUBBER TAPE

MADE BY JENKINS BROS. . . . . MAKERS OF FAMOUS JENKINS VALVES




# *Better Lubrication with* Gulf Parvis Oil *means Lower Maintenance Costs!*

**Gulf Parvis Oil provides the kind of protection your Diesels need now**

Maintenance costs usually tell the story of lubrication efficiency—and Diesel maintenance costs are *low* with Gulf Parvis Oil in service.

This superior Diesel lubricant has been perfected during the last fifteen years through research effort and far-flung field service in most types of Diesels and under a wide variety of operating conditions. It has many outstanding performance records.

If you are not one of the hundreds of enthusiastic users of Gulf Parvis Oils, it will pay you to investigate—call in a Gulf Lubrication Service Engineer and ask him to recommend the proper type and grade to fit your particular requirements.

Gulf Parvis Oil—and the more than 400 other quality oils and greases in the Gulf line—are available to you through 1,200 warehouses in 30 states from Maine to New Mexico. Write, wire, or phone your nearest Gulf office today.

**Gulf Oil Corporation · Gulf Refining Company · Gulf Building, Pittsburgh, Pa.**

GULF INDUSTRIAL LUBRICATION

*Back the attack . . buy more War Bonds*

# WHERE NOTHING BUT *All-Wheel-Drive* COULD GET THROUGH

Out in the Imperial Valley of California, the public owned utility which diverts and distributes irrigation water to 500,000 acres of farm lands, had a not uncommon problem. Some method of keeping down the rank growth of weeds and moss on the ditch banks had to be found, to prevent choking up the channels and retarding the flow of water.

Solution of the problem was found in equipping a fleet of Marmon-Herrington *All-Wheel-Drive* converted Ford trucks with flame throwers. With ability to travel through the soft weed-covered ground, up and down the ditch banks, the Marmon-Herringtons enable the weed-burning crews to keep the vegetation under control over 3,000 miles of ditches.

Here, as in laying and servicing water mains, stringing and maintaining power, light, telephone and telegraph lines, and in oil production, road construction, snow removal, etc., Marmon-Herrington *All-Wheel-Drive* makes an important contribution to America's internal war program. If interested, write for literature.

★ *BACK THE ATTACK* • *BUY MORE BONDS* ★

# MARMON-HERRINGTON

# *All-Wheel-Drive*

MARMON-HERRINGTON CO., Inc., INDIANAPOLIS 7, INDIANA

Cable Address: MARTON

# NERVE CENTERS... *in fox holes*

Official photo, U. S. Marine Corps

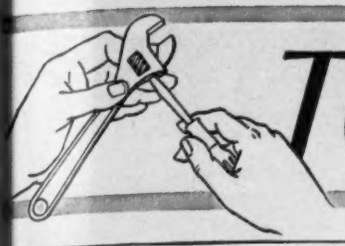
• In these front line communication centers, too, Burndy Connectors play an important role. In stringing wires, for example, where the split-second is vital in making *sound* connections, the popular **SERVIT** is used. For equipment connections, **SCRULUGS, QIKLUGS, HYLUGS** and other Burndy types are extensively employed.

Likewise in our fighting aircraft; on ships, tanks and other electrified war equipment, vital electrical connections are made the **BURNDY** way . . . with the same *speed, efficiency* and *security* which have kept Burndy connectors *leaders* for all peacetime needs.

**Burndy** Headquarters for CONNECTORS

**BURNDY ENGINEERING CO., INC., 107 Eastern Boulevard, New York 54, N. Y.**

IN CANADA: Canadian Line Materials, Limited, Toronto 13

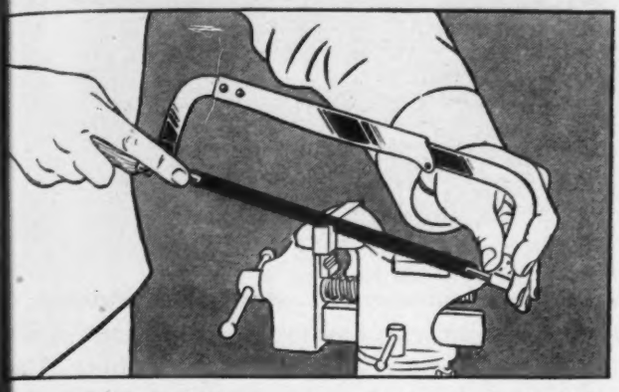


# TOOL NOTES

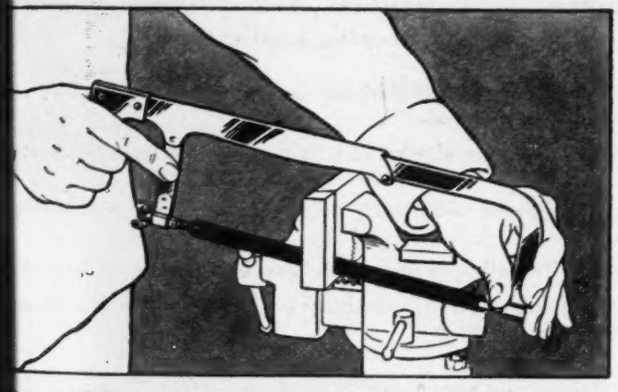
"How To Do It" Information For Crescent Tool Users

## No. 18 . . . . PICKING THE PROPER TOOL FOR THE JOB

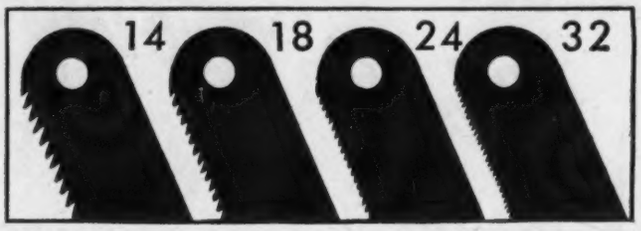
With Hacksaws, the question of picking the proper type concerns the blade more than the frame. However, reasonable judgment should be exercised in choosing a saw for a specific job.



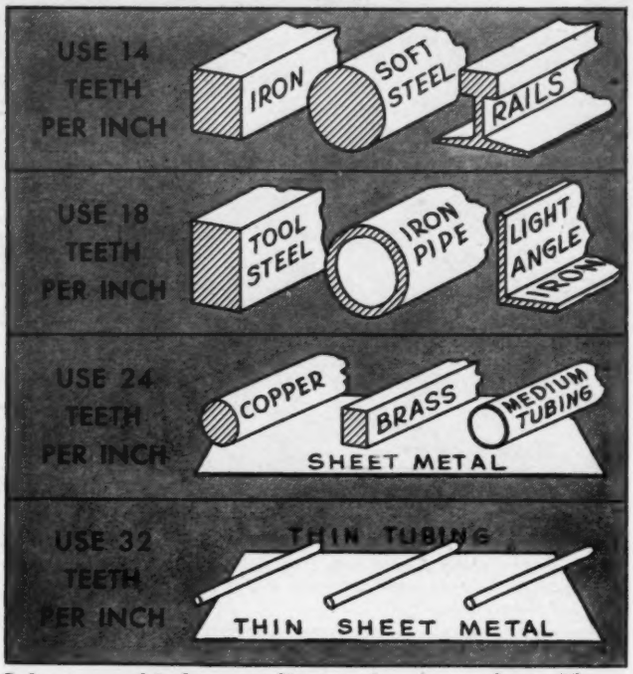
Crescent's No. 1042, for example, is relatively light and is intended for average rather than heavy duty service. Depth of cut is another matter to be considered. The frame above cuts only to a 2-1/2" depth, which might not be sufficient for the job at hand.



Crescent's No. 1047, with its heavy rigid frame, on the other hand is designed for the hardest work imaginable. Its 3-1/4" depth of cut is sufficient for the job illustrated and its big, comfortable, pistol-grip handle enables the operator to put more power in the cutting stroke.




Blades are made with a varying number of teeth per inch, ranging from 14 to 32. Selection of the blade should be based upon material to be cut. Blades with 18 teeth per inch are the best for general use, but there is no such thing as an "all-purpose" blade.




Select your blade according to the above chart. Never permit a condition wherein the teeth "straddle" the work. Use a blade of finer pitch or change the angle between blade and work so at least two teeth are always engaged. Have work securely held when sawing.

## MAIL THE COUPON FOR FREE REPRINTS

This is No. 18 in Crescent's TOOL NOTES Series. These informative advertisements provide practical information for users of hand tools. Mail the coupon today!

**CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.**

**CRESCENT TOOLS**
*Give Wings to Work*

Crescent Tool Co., Jamestown, N. Y. I-4

Please send your "TOOL NOTES" Series

☐ for Bulletins ☐ for 3-ring binder

*Name* _____

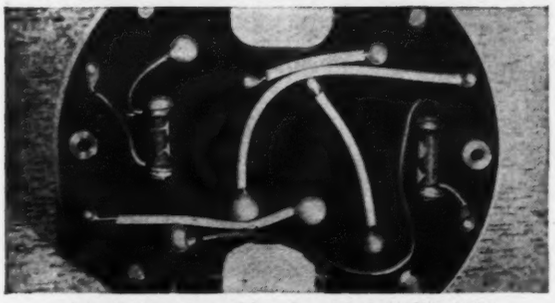
*Address* _____

*City* _____ *State* _____

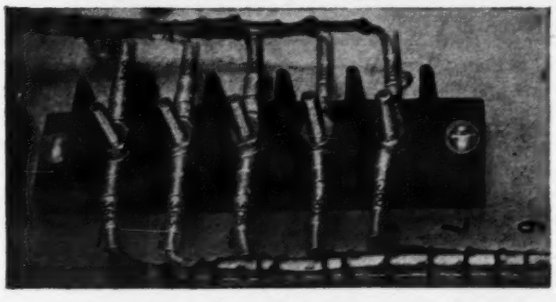
# IRVINGTON *Plastic Tubings*

## INSULATE THE "NERVES" THAT MAKE THINGS HAPPEN

*Bell Aircraft Corporation protects the wiring of inertia starters for their famous P-39 Airacobras with a conduit of flexible, abrasion-resistant Hyflex.*



*Insulation on soldered wires of this 3½" diameter, temperature indicator is Irv-O-Lite XTE-30. It was specified by the Lewis Engineering Company, Naugatuck, Conn. Note how close the tubing is to the soldered connections.*



*Transflex is used on the terminals of the main electrical distribution box of Mainliner planes, operated by United Air Lines. Besides insulating the lugs, this transparent tubing permits immediate identification and inspection of the terminals.*

On communications equipment . . . sensitive instruments . . . lighting, ignition and control systems . . . millions of wire "nerves" are protected by Irvington Plastic Tubings. Used as conduit, wire covering and terminal insulation, these flexible tubings provide dependable insulation even under severe operating condition.

All five Irvington Plastic Tubings satisfy general insulation requirements. In addition, each possesses properties which meet the needs of specific applications.

**IRV-O-LITE XTE-30 is a good, all-purpose insulation. Wires covered with XTE-30 can be readily soldered.**

**IRV-O-LITE XTE-130 has unusual oven life. It is unaffected by a temperature of 105 deg. C. for 1,000 consecutive hours.**

**TRANSFLEX is transparent and resists brittleness at temperatures as low as −58 deg. F.**

**HYFLEX, similar to Transflex in properties is available in six opaque colors.**

**IVI-FLEX is rubberlike and resists extremely low temperatures. It withstands a hammer blow at −70 deg. F.**

All these tubings are resistant to acids, alkalies, denatured alcohol and petroleum products, including gasoline.

*For more information on specific properties of each Irvington Plastic Tubing, send for this catalog. Write Dept. 46*

**IRVINGTON VARNISH & INSULATOR CO.**
IRVINGTON, NEW JERSEY, U. S. A.
Plants at Irvington, New Jersey, and Hamilton, Ontario, Canada
Representatives in 29 Principal Cities

### POST-WAR PLANNERS

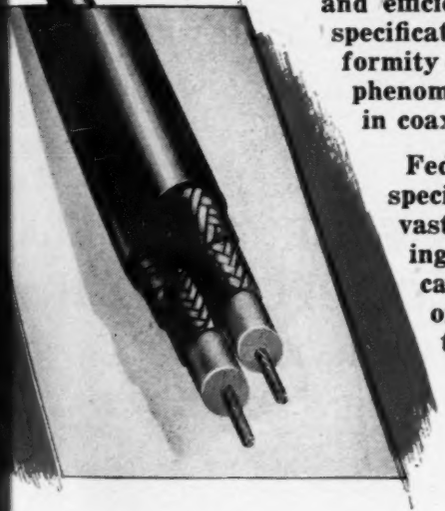
Although our machines are now devoted to the extrusion of tubing for electrical insulation on war equipment, we are preparing to meet your post-war demands for extruded shapes, rods, and thread. Write us of your requirements.

**IRVINGTON *Electrical* INSULATION**

# . . . Federal's Coaxial Transmission Line Proves Its Stamina on Every Front

**In any area of combat and wherever the performance requirements are most severe, there Federal's Ultra High Frequency Coaxial Cable measures up to every test for extreme ruggedness, strength and endurance.**

***Radio Ranges and Instrument Landing Systems manufactured by Federal mark the principal air routes of the Nation and control the landing at many leading airports. Pioneers in the development of Aerial Navigation Equipment, Federal has made spectacular contributions to aviation progress.***



**Made of solid dielectric, flexible, moisture-proof and efficient in any temperature — meeting all specifications with precision accuracy and uniformity — Federal's Transmission Line embodies phenomenal characteristics never before achieved in coaxial cable manufacture.**

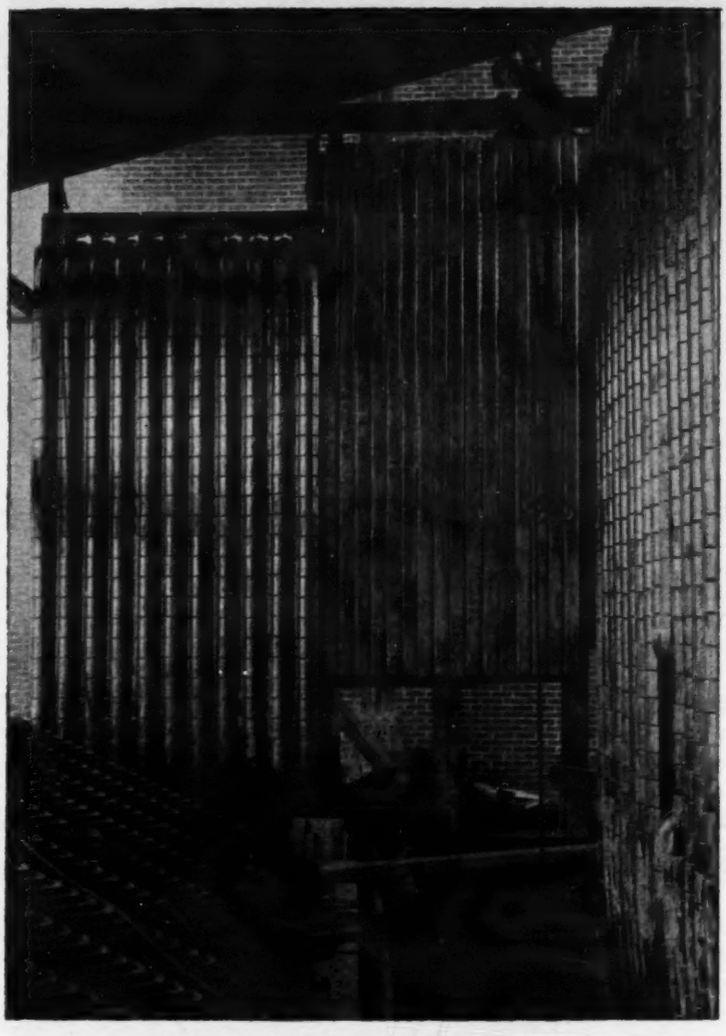
**Federal is outstanding in the field because it specializes in High Frequency Coaxial Cable, with vast experience and knowledge behind its pioneering developments. It is the largest high frequency cable manufacturer, producing in volume a range of sizes from the smallest for delicate and sensitive instruments to power cable for heavy service.**

**Federal's engineering skill is ready to solve any high frequency cable problem. Its productive capacity, keyed to all special demands, will make and deliver any required size, low loss, quality, Solid Dielectric Ultra High Frequency Coaxial Transmission Line.**

## *Federal Telephone and Radio Corporation*

INTELIN DIVISION — An IT&T Associate — Newark, N. J.

# Blazing THE



Waterwalls and radiant superheater in a 1276 H.P. boiler of a large public utility plant built in 1926.

It is well known that with improved combustion methods and the increase in the size of boilers, higher furnace temperatures resulted in prohibitive maintenance costs on brickwork. Foster Wheeler tackled this problem and was among the first to replace refractory walls with water and steam cooled surfaces, making the first installation of water cooled furnace walls in 1922.

**Intelligent application of engineering fundamentals, motivated by research, and tempered with the "know how" of long experience constitute the keystone of progressive engineering. Through the years Foster Wheeler has successfully applied this formula; thereby contributing in no small measure to significant advances in steam generator design. Three examples prominent in universal service are the "individual" external economizer, radiant type superheaters and water-cooled furnace walls.**

**FOSTER WHEELER CORPORATION**

**165 BROADWAY**

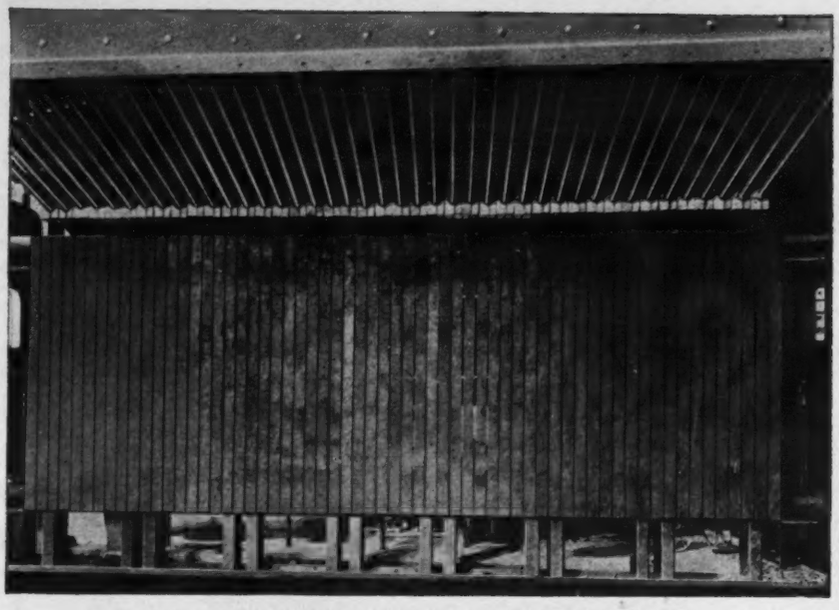
**NEW YORK 6, N. Y.**

FW FOSTER

# ENGINEERING TRAIL

● To utilize the high heat transfer rates of radiant heat in furnaces and the protection which steam cooled walls afford refractory, Foster Wheeler developed and installed the first radiant superheater in 1917. This advance in furnace practice was the forerunner of combination superheaters which insure constant final steam temperature over wide fluctuations of load.

Foster-Wheeler is a Three-Star winner under the U. S. Navy Board of Awards for production.



Radiant superheater designed for 60 deg. superheat in a 600 H.P. boiler of a New England industrial concern. Installed in 1925.

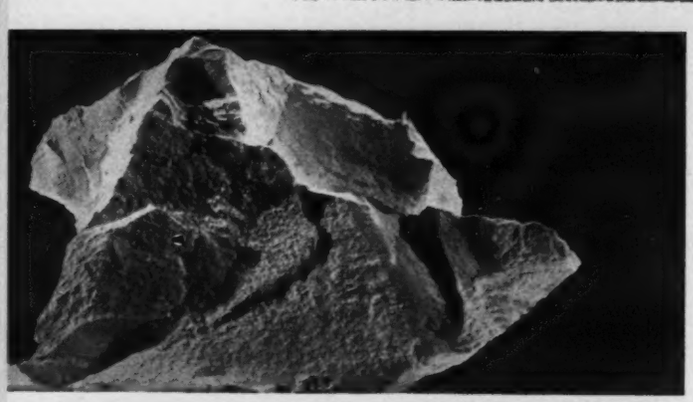
3416 sq. ft. extended surface economizer installed in 1925 in a Mid-western industrial plant.

● Today the vast majority of large steam generators are equipped with individual economizers. Twenty-four years ago that was not the case—it was then that Foster Wheeler installed the first extended surface, forced water flow, high pressure, high gas velocity economizer as an "individual" unit to service one boiler. This economizer was deliberately designed for high draft loss on the economic principle of maximum work from minimum economic surface. Foster Wheeler has installed more than 4,500 extended surface units—indisputable proof of superlative performance.

# WHEELER

# What's behind

PINCO INSULATORS



The clays that go into Pinco Insulators are carefully selected for the properties that will combine to give a close-grained, impact resisting porcelain. China clay, the same white clay identified with the White Cliffs of Dover, comes from Devonshire, England; ball clay, from Cornwall, the land of Jack the Giant Killer.

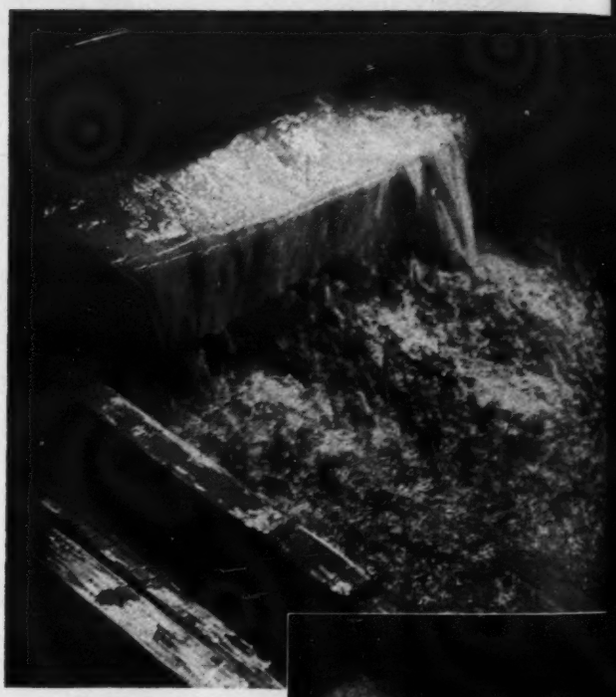
Flint and feldspar, after being ground together in a ball mill, are added to the clay in the exact proportions. The flint comes from Pennsylvania; the feldspar is a specially prepared blend of the finest American and Canadian feldspars.

**From the selection, inspection and blending of the various clays that go into it, the manufacture of a Pinco Insulator is a precision engineering operation.**

Send for your copy of the new Pinco Catalog, just off the press, showing Pinco Standard Insulators and Hardware and including an identification of styles permitted under WPB order L-154.

Pinco Standard Insulators are cataloged in the Electrical Buyers Reference.

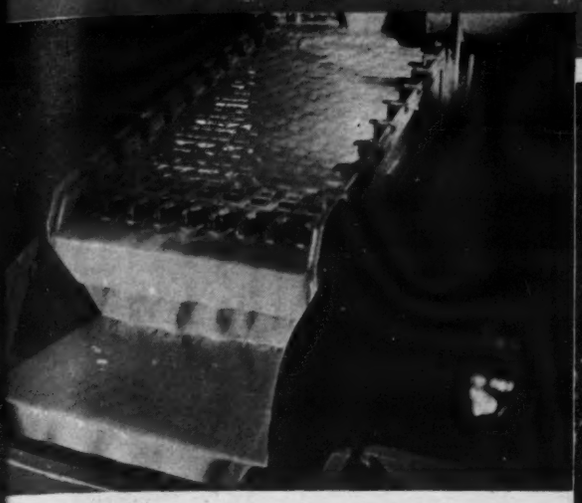
***No. 1 of a series telling the story of Pinco Insulators . . . from clay bin to shipping crate.***



Much in the same manner as the old time placer miner separated gold from sand, this lawning operation, the first of three such operations, separates the impurities from the clay. The clay, mixed with water, is fed to a mechanically vibrated lawn screen filter, thus insuring a uniformly fine texture to the clay mixture.

At the right is shown some of the impurities and foreign matter screened from the ball clay during a short period of operation.

# "RIGHT on the job" service



maintain the high insulating qualities for which Pinco ulators are generally recognized, it is important that no tallic particles should be present in the clay. To separate remove them, the clay and water mixture is passed over through a set of powerful electro-magnets.

most exacting standards govern the operations shown , as well as those to come. Each has a definite relation to final strength of the porcelain as shown by exacting ratory tests.

he result of proper clay blending and mixing shows up in flexural strength test of a fired porcelain rod. It took 00 p.s.i. to break this sample. Thus, working to definite neering specifications in every stage of manufacture o produces insulators that are *"right on the job"*

PINCO No. 735

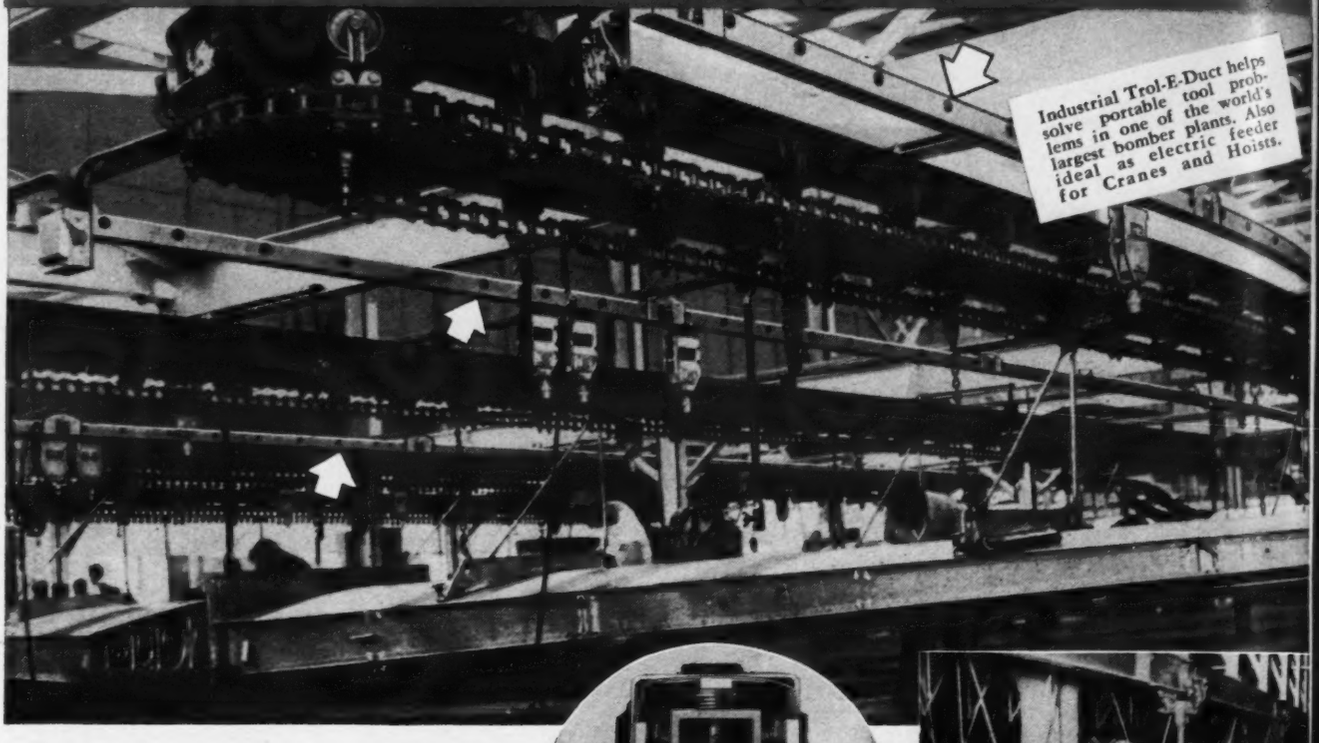
## The Porcelain Insulator Corporation

**651 Main Street, Lima, New York**

**SALES AGENTS**—The Joslyn Company—New York, Rochester, Philadelphia, Baltimore, Washington, Richmond and Lynchburg, Va.; Jobbers Supply Co.—St. Paul, Portland, Seattle; Joslyn Co. of California—Los Angeles, San Francisco, Phoenix, Ariz.; Southern Joslyn Co.—New Orleans; H. E. Burns Co.—Pittsburgh; J. J. Costello—Boston; Southeast Joslyn Company—Cincinnati, Cleveland, Westerville, O.; Lexington, Ky., Atlanta, Jacksonville; Paul Douden—Denver; Paul Carson—Amarillo, Texas; Joslyn Manufacturing & Supply Co.— Chicago, Springfield, Ill., Kokomo, Ind., Kansas City, Omaha, Oklahoma City; Joslyn Southwest Co.—Dallas, Houston.

# POWER FOLLOWS THE JOB

## IN GREAT U. S. AIRCRAFT PLANTS


Industrial Trol-E-Duct helps solve portable tool problems in one of the world's largest bomber plants. Also ideal as electric feeder for Cranes and Hoists.

## INDUSTRIAL TROL-E-DUCT BRINGS POWER CLOSE TO THE TOOL

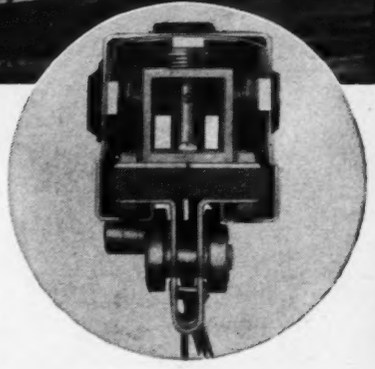
In these days of fast-moving production lines and frequent changeovers, war plants must have a *movable* source of power for portable tools.

Only Industrial Trol-E-Duct can fully meet this need. Here, the source of power moves right along with the tool and the tool moves right along with the work.

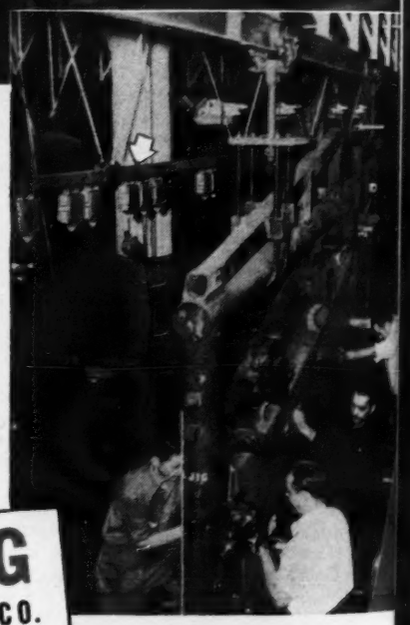
Gone are the hazards and interruptions caused by fixed plug-in points. With Industrial Trol-E-Duct, safety goes up, production time goes down and extensive savings are effected in wiring and other fixed equipment.

*Because of its special enclosed design it is ideally adapted to crane and hoist applications in place of the dangerous open trolley wire.*

Write for descriptive folder giving complete details.



BullDog's new "T" type sliding disc trolley conserves critical material without any sacrifice of operating effectiveness.



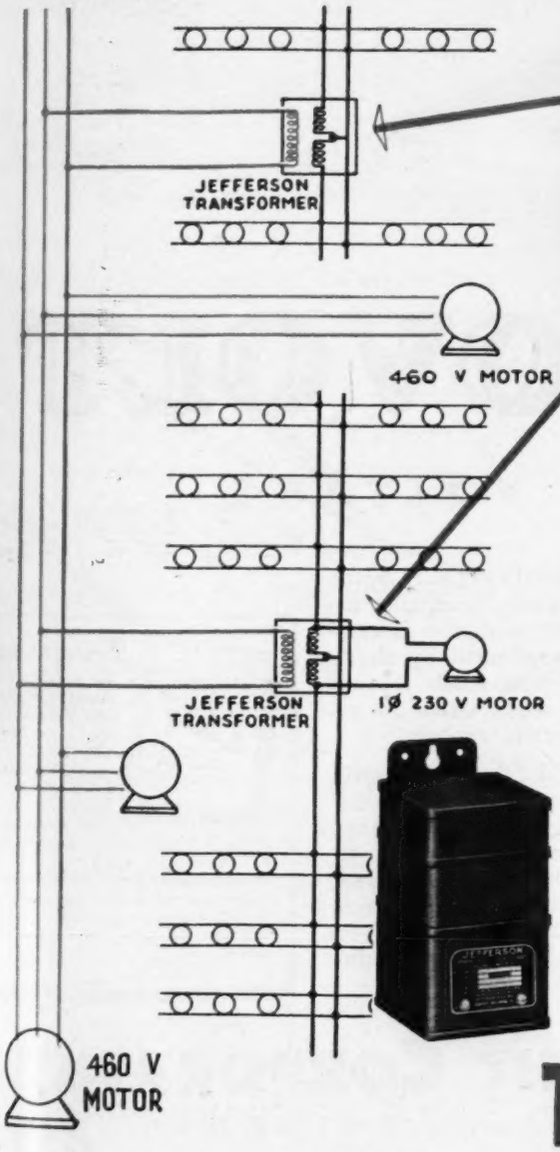
How power follows the tools in another big war plant building wings for combat planes.

**BULLDOG**
**ELECTRIC PRODUCTS CO.**
Box 177, R. Pk. Annex
Detroit 32, Michigan
BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

In addition to its three famous lines of Bus Duct, BUStribution DUCT *for "plug-in" power,* Universal Trol-E-Duct *for flexible lighting* and Industrial Trol-E-Duct *for movable "loads,"* BullDog Electric Products Company manufactures a wide line of other products for power distribution and control, including Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers and Switchboards.

# SAVE COPPER · ·
# SAVE MANPOWER · ·
# SAVE CONDUIT · ·

## RUN ONLY HIGH VOLTAGE CIRCUITS
### Throughout Plant or Building




**Install Dry-Type Jefferson Electric Power Circuit Transformers for the Lower Voltage Circuits ▪ ▪ ▪**

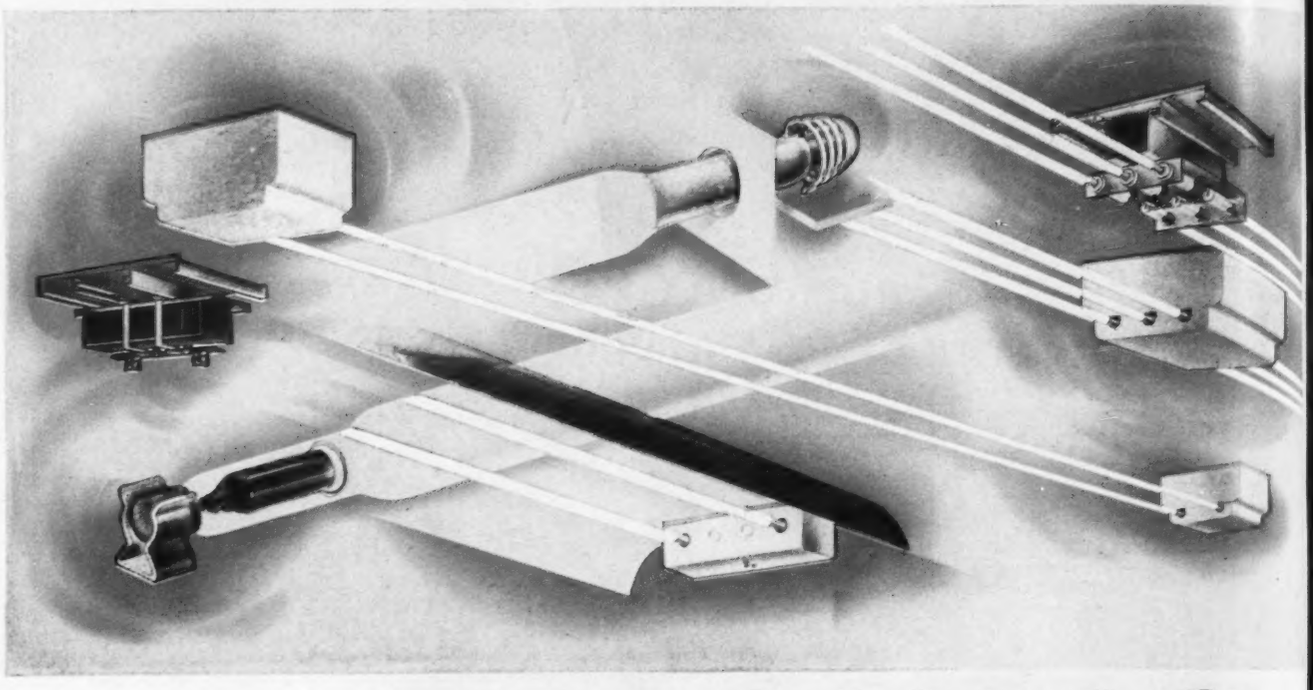
■ Operate lighting load, fractional H. P. motor and appliance from 3-Phase 460-Volt Power lines by use of Jefferson Power Circuit Transformers for reducing voltage to conventional 115/230 Volts single phase at usage points. This system may be employed in new buildings, saving conduit, copper and manpower, or in old plants where power increases require larger lines to carry the load. In the latter case the 230/115V system can be changed to 3-Phase 460-Volt and carry twice the load previously carried while using the same wires and the same conduit already installed.

Ideal for tall buildings, plants, mines, warehouses, depots, campsites, shipyards and the like. For complete data refer to Bulletin 421-PCT. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. Canadian Factory: 60-64 Osler Avenue, W. Toronto, Ontario.

JEFFERSON
ELECTRIC

# TRANSFORMERS

# Turn "lumen hours" into "lumen years"



## ...THE NEW COLOVOLT lamps

## COLD CATHODE LOW VOLTAGE

**8000 HOURS** of rated life is what the new COLOVOLT lamps offer you! Is it any wonder that we say "lumen hours" turn into "lumen years" with cold cathode low voltage fluorescent lighting the new COLOVOLT way!

8000 hours of rated life (guaranteed for one year) insures *low maintenance* cost, which means maximum lighting efficiency, actually *greater than any previously known cold cathode lighting.*

Operation is on *low* voltage, eliminating high voltage wiring and bulky transformers (although lamps may be used for high voltage operation if desired). Moreover, COLOVOLT lamps start up immediately—require no starters. Colovolt illumination is constant—steady and unaffected by shock or vibration. The lamps are free of "strob" or flicker when used on capacitative and inductive reactor.

Available in standard 7 ft. 9 in. lengths, these lamps give longer light sources . . . better line lighting. As package items, the lamps compare most favorably with custom-built cold-cathode lighting in every respect! All of the special features of COLOVOLT are possible only because absolutely new lighting principles are employed.

***Send today*** for booklet "Facts About Cold Cathode Low Voltage Lighting" . . . written in concise, understandable terms. Booklet tells where and how to use cold cathode (low or high voltage) lighting. Complete with performance charts and data to give a comprehensive picture of the advantages and the disadvantages of cold cathode fluorescent lighting for all types of lighting problems. Request your copy today!

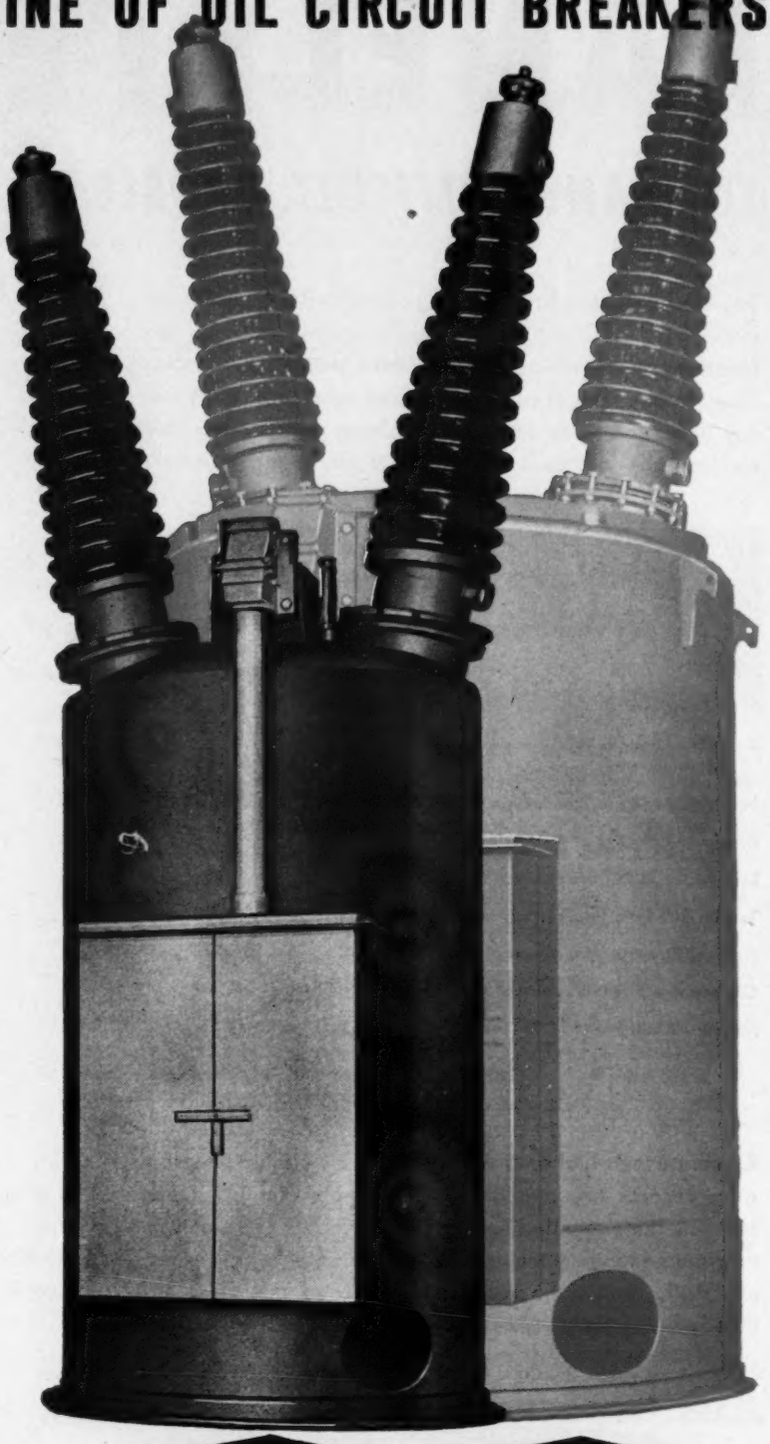
## GENERAL LUMINESCENT CORPORATION

638 SOUTH FEDERAL ST., CHICAGO, ILL.

# ANNOUNCING A NEW LINE OF OIL CIRCUIT BREAKERS

★
smaller size
★
faster opening
★
lower prices
★

**...115 kv and above with 5 cycle opening time**



To improve system stability on loaded, high voltage power lines, Westinghouse announces a new, smaller, faster opening, and lower priced GM breaker with 5-cycle opening time.

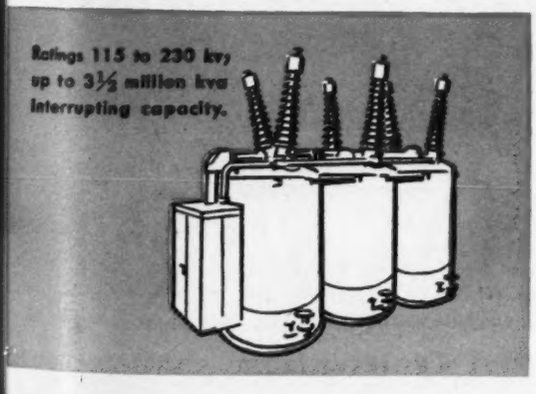
SMALLER than the 8-cycle breakers they supersede, these new breakers require less oil and oil handling and smaller foundations.

FASTER 5-cycle opening time on breakers 115 kv and above represents a standard feature long requested by users : : : it improves system stability.

LOWER PRICED than the breakers they replace, the new line represents the greatest breaker value ever offered by Westinghouse.

For complete information, call your nearest Westinghouse office. Or write Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa. Ask for bulletin DD-33-805.

J-60543




NEW
Type GM
5-cycle opening time

OLD
8-cycle opening time

Westinghouse
PLANTS IN 25 CITIES OFFICES EVERYWHERE

*Circuit Breakers*

# PANELYTE* THE READY SOLUTION

## TO MANY DIFFICULT PROBLEMS IN ELECTRICAL DESIGN!

Engineer-designers of electrically-energized products look to PANELYTE, the structural plastic, for certain valuable combinations of dielectric and mechanical properties, not duplicated in any natural or manufactured substance. Each varying grade of these laminated resinous plastics has been developed — not as a substitute for any other material — but to give more efficient performance, lengthen service life or lessen production time — and costs — on specific applications. It is this unique association of properties, characteristic of all PANELYTE Plastics that has made possible the design or improved design of many structural parts recognized as important advances in the electrical industry.

**PANELYTE PROPERTIES AT A GLANCE**
**Typical Paper-Base Grades For Electrical Applications**

| | Grade #520 Nema Grade XXX | Grade #550 Nema Grade XX | Grade #750 Nema Grade X | Grade #770* Nema Grade P | Grade #772 Nema Grade P | Grade #774 Nema Grade XXP | Grade #776 Nema Grade XXXP |
|---|---|---|---|---|---|---|---|
| Dielectric Strength Short Time Method 1/8" volts/mil. | 575 | 625 | 700 | 775 | 785 | 675 | 600 |
| Power Factor at $10^6$ cycles/sec. | .033 | .039 | .045 | .048 | .057 | .035 | .022 |
| Dielectric Constant at $10^6$ cycles/sec. | 4.8 | 5.1 | 5.6 | 5.5 | 5.9 | 5.0 | 4.8 |
| Loss Factor at $10^6$ cycles/sec. | .158 | .199 | .250 | .264 | .336 | .175 | .106 |
| Tensile Strength, lbs. per sq. in. | 11,000 | 12,000 | 15,000 | 11,000 | 11,000 | 10,000 | 9,000 |
| Flexural Strength, lbs. per sq. in. | 16,000 | 17,500 | 23,000 | 18,000 | 18,000 | 15,000 | 13,000 |
| Compressive Strength, lbs. per sq. in. | 39,000 | 40,000 | 44,000 | 38,000 | 38,000 | 35,000 | 32,000 |
| Moisture Absorption, 24 hr. immersion, 1/8", % | 0.70 | 1.10 | 1.90 | 1.60 | 1.80 | .087 | .050 |

**NOTE:** All tests were made in accordance with the latest A.S.T.M. test specifications.
All values represent average test figures.
*Special radio grade punching material with better electrical properties than Grade 772.

Complete technical data on PANELYTE Plastics and performance records are available. Test samples furnished upon request. The expanded facilities of the PANELYTE plant, and new manufacturing techniques developed by our engineering staff, permit the mass production of the most intricate parts — molded or fabricated in strict accordance with specifications. Our comprehensive knowledge, gained through long and close cooperation with leading manufacturers in the electrical field, may be of help to you. This assistance is yours either on immediate problems or in planning for peace-time markets.

**Write for factual data book**

*

**MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS**

**PANELYTE** *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

*Sales Offices:* Atlanta, Boston, Chicago, Dallas, Denver, Detroit, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

**Experienced and reliable Fabricators in Industrial Centers from coast-to-coast**

# 25,000 REASONS WHY YOU MIGHT WANT TO KNOW US BETTER

IT takes a lot of research to make American glass the best in the world. At Corning, for example, more than 250 engineers and laboratory men are working steadily on new forms of glass and new uses for this amazing material. *More than 25,000 formulae for glass have been developed!*

Today, out of this vast experience, has emerged an amazingly versatile group of glasses in daily production under the Army-Navy "E" pennant at Corning. Glasses with an expansion coefficient practically equal to that of fused quartz; glasses that have high electrical insulating qualities; glasses that are extremely resistant to mechanical shock; glasses that can be made into intricate shapes formerly considered impossible. More than that, many of these developments have meant money saved to the customer and faster deliveries.

For example, steady progress has been made in methods of connecting glass to metal. First, we used Antimony Lead Alloy as a coupling medium; then metal coats were sprayed on glass. Today, a Hermetic Metallizing process has been developed which is a vast improvement over former techniques. And Corning's laboratory is already working on further improvements to make glass-to-metal seals better and cheaper.

If you are a manufacturer of electronic equipment, Corning's "know-how" in glass is at your service. We shall be glad to work with you at any time on any problem involving the possible use of glass. In the meantime, you may be interested in a detailed study "Glassware in the Electrical Industry." Simply write to the Electronic Sales Dept. W-2, Bulb and Tubing Division, Corning Glass Works, Corning, N. Y.

CORNING *means* Research in Glass

## *Electronic Glassware*

T.M.REG. CORNING U.S. PAT. OFF. T.M.REG. PYREX U.S. PAT. OFF.

"PYREX" *and* "CORNING" *are registered trade-marks of Corning Glass Works*

# NEW FREE BOOK tells how to keep fire-fighting equipment in shape

When fire strikes at your plant — will your extinguishing equipment be *ready?* A clogged nozzle, a cylinder not fully charged — these and dozens of other results of negligence can make your fire-fighters useless when you need them most. Regular, systematic inspection is the only way to make sure your equipment's in fighting trim.

To help you set up a maintenance system in your organization, Walter Kidde & Company has prepared a booklet —"Inspection and Maintenance of Fire Extinguishers." It tells how to check whether you have the proper types and quantities of extinguishers; how to mark them for quick identification; how often the various types should be inspected; what parts to examine on each unit. It suggests simple forms for keeping records. This booklet is on the press now. Write for your free copy today.

**WALTER KIDDE & COMPANY, INC., 225 MAIN STREET, BELLEVILLE, N. J.**

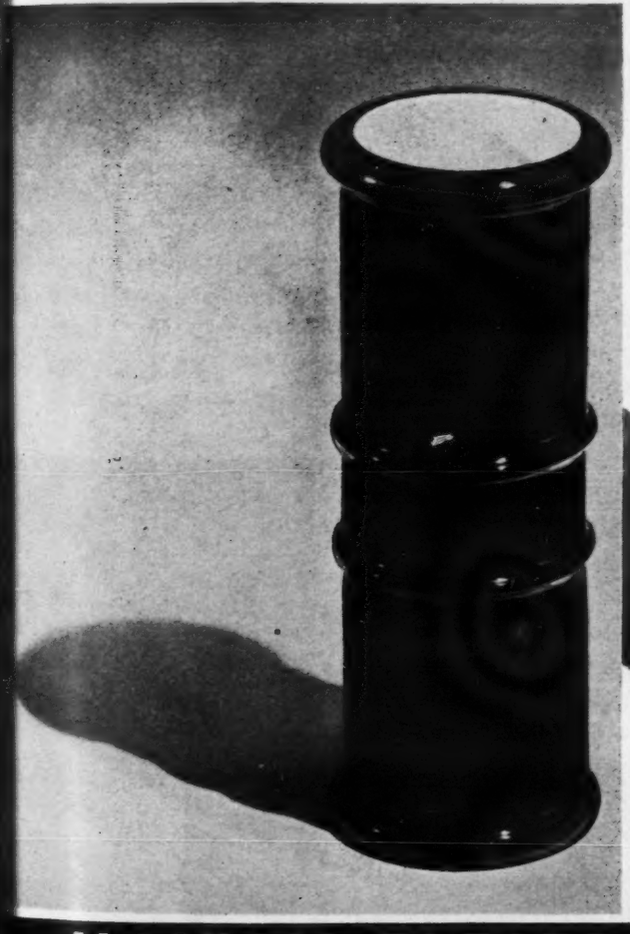
# ILLINOIS

## LIGHTNING ARRESTER PORCELAIN HOUSINGS

● Many applications of ILLINOIS Lightning Arrester Porcelain Housings have already been made. The measure of satisfaction is the lack of rejected pieces by the various lightning arrester manufacturers who have specified ILLINOIS.

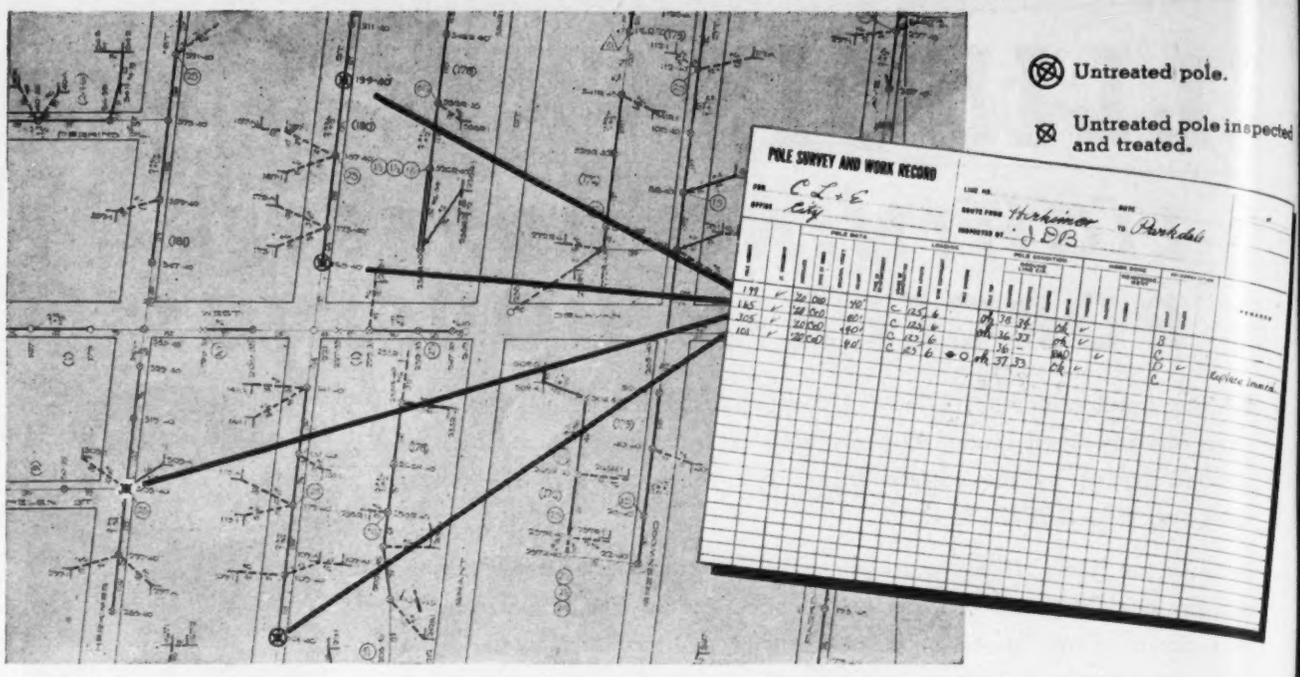
Because the ILLINOIS organization supplies correctly made and dimensionally perfect porcelains, the over-all cost of the finished arrester is kept down. Every piece of porcelain shipped from this plant to the lightning arrester manufacturers is exactly to specifications furnished.

In producing these porcelains it is not necessary to treat each piece as a special because our process of manufacture assures uniformity regardless of the number produced for one order.



●
HIGH
MECHANICAL STRENGTH
●
HIGH
DIELECTRIC STRENGTH
●
EXACT DIMENSIONS
AND UNIFORMITY
●

**ILLINOIS ELECTRIC PORCELAIN CO.**
MACOMB, ILLINOIS



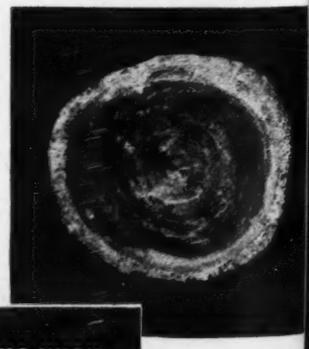

# *How One Leading Utility makes*

# INSPECTION TIME PROTECTION TIME *with* OSMOPLASTIC

Reproduced above are the basic records employed by a large electric utility to accurately control the maintenance of standing poles in their overhead distribution system.

Under this system, every pole is numbered and mapped. A glance at the map shows the condition of all poles in the area covered . . . symbols indicating whether they are treated or untreated. Filed with the map, is a pole inspection record giving detailed information on the poles which need treating, plus the data on those which have been inspected and treated. Thus does one utility intelligently MAKE INSPECTION TIME PROTECTION TIME with OSMOPLASTIC.

Today, more than 100 prominent utilities are treating poles with OSMOPLASTIC. To date, over a million and a half poles have been so treated to greatly increase their useful life. If you are interested in a record control system similar to that described above, we would be glad to discuss the matter with you in detail.



The white outer area of this pole cross-section, cut at groundline, shows the deep penetrating action of the toxic chemicals in Osmoplastic.

MAKE INSPECTION TIME, PROTECTION TIME WITH

**OSMOPLASTIC**

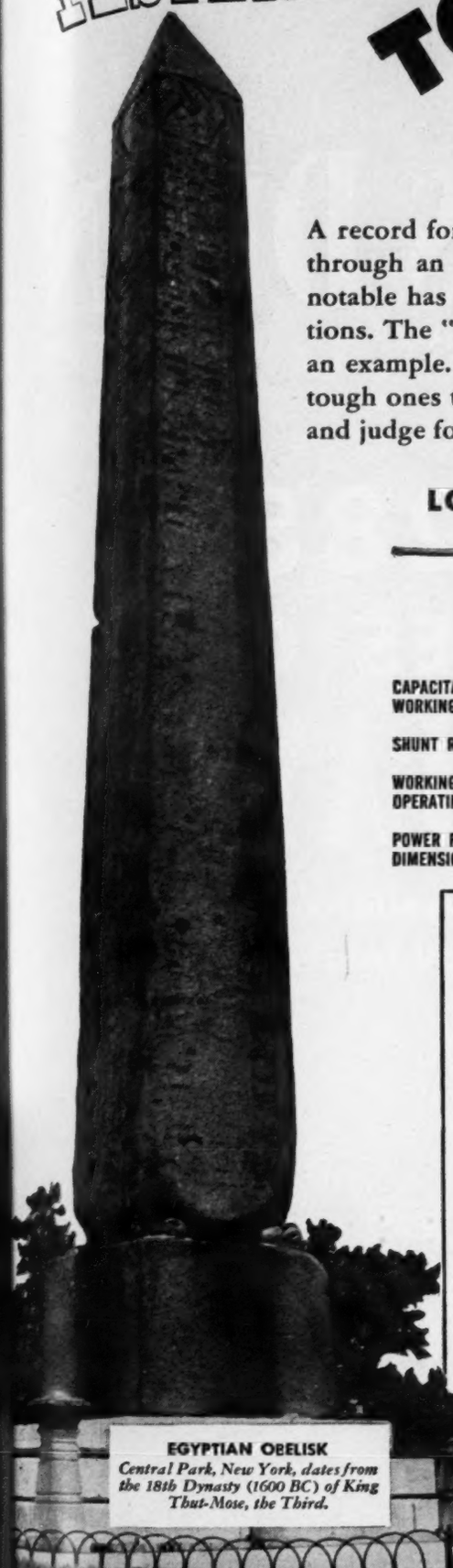
MANUFACTURED BY

OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.

GENERAL OFFICES: BUFFALO 12, N. Y.

BRANCH AND SALES OFFICES: BIRMINGHAM 3, ALA.; DENVER 2, COLO.; NEW YORK 7, N. Y.; KENOVA, W. VA.; HARLAN, KY.; CHICAGO 4, ILL.

# YESTERDAY... TODAY... *Tomorrow*



**EGYPTIAN OBELISK**
*Central Park, New York, dates from the 18th Dynasty (1600 BC) of King Thut-Mose, the Third.*

A record for long life has been earned by Tobe Capacitors through an almost complete absence of "returns". Equally notable has been Tobe's ability to master difficult specifications. The "DP" Molded Paper Condenser shown below is an example. The new American War Standards "specs" are tough ones to meet—but we meet them. Ask us for samples and judge for yourself.

**LONG LIFE** **ASSURED**



## SPECIFICATIONS "DP" MOLDED PAPER CONDENSERS

**CAPACITANCE**.....001 to .04 MFD
**WORKING VOLTAGE**.....*See chart below*
Flash test 3 times rated DC working voltage
**SHUNT RESISTANCE**.....At 185° F— 1000 megohms or greater
At 72° F—50000 megohms or greater
**WORKING TEMPERATURE RANGE**.....Minus 50° F to plus 185° F
**OPERATING FREQUENCY RANGE**.....Upper limit 40 megacycles
Q at one megacycle—average 20
**POWER FACTOR**.....At 1000 cycles .004 to .006
**DIMENSIONS**.....13/16" x 13/16" x 19/64"

| Capacity in MMFD. | DC Working Voltage Rating | TOBE & AMERICAN WAR STANDARDS DESIGNATIONS "A" Characteristic | "B" |
|---|---|---|---|
| 1000 | 600—1500 | CN35A102 | CN35B102 |
| 1500 | 600—1500 | CN35A152 | CN35B152 |
| 2000 | 600—1500 | CN35A202 | CN35B202 |
| 2500 | 600—1250 | CN35A252 | CN35B252 |
| 3000 | 600—1000 | CN35A302 | CN35B302 |
| 4000 | 600—1000 | CN35A402 | CN35B402 |
| 5000 | 600— 800 | CN35A502 | CN35B502 |
| 6000 | 600— 800 | CN35A602 | CN35B602 |
| 7000 | 500— 700 | CN35A702 | CN35B702 |
| 8000 | 500— 700 | CN35A802 | CN35B802 |
| 10000 | 400— 600 | CN35A103 | CN35B103 |
| 20000 | 200— 300 | CN35A203 | CN35B203 |
| 30000 | 50— 150 | CN35A303 | CN35B303 |
| 40000 | 50— 100 | CN35A403 | CN35B403 |

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

A SMALL PART IN VICTORY TODAY — A BIG PART IN INDUSTRY TOMORROW

# STRUTHERS-DUNN
INCORPORATED

## 5,288 TYPES OF RELAYS

Each available in
countless coil combinati ns

1321 ARCH STREET, PHILADELPHIA 7, PA.

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND
DALLAS • DENVER • DETROIT • HARTFORD • INDIANAPOLIS • LOS ANGELES • MINNEAPOLIS • MONTREAL
NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

# Battle for Salerno

The bitter, bloody battle for Salerno was fought not only on the beaches, but in the harbor beyond the shore, where allied Naval Units joined in the bombardment of enemy positions.

This official U. S. Navy photograph—taken as tension eases at Salerno—shows Lt. Gen. Mark W. Clark, USA (right), and Vice Admiral H. K. Hewitt, USN, standing by the rail of their "floating headquarters" in the bay.

Alongside them is shown a compass—in which is a Bearing Circle Navigation Instrument, a product of the Eastern Specialty Co.

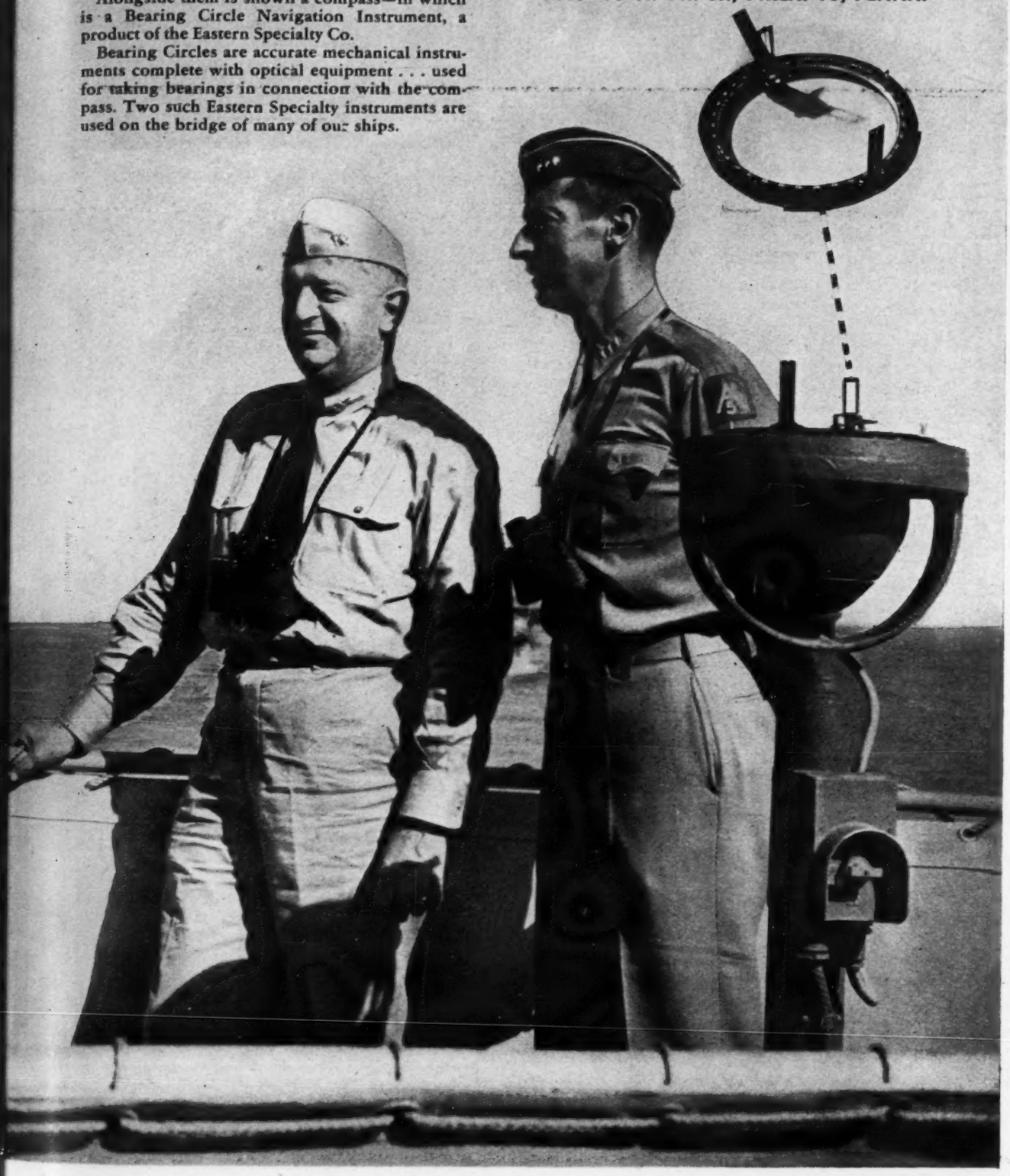
Bearing Circles are accurate mechanical instruments complete with optical equipment . . . used for taking bearings in connection with the compass. Two such Eastern Specialty instruments are used on the bridge of many of our ships.

This is only one of numerous specialties made by us in aiding the war effort. Normally, we specialize in electrical testing equipment for utilities. However, we are equipped to make many precision, electrical and mechanical instruments for any field or purpose.

We invite you to discuss your problems with us today.

THE *Eastern Specialty* CO.

**3617-19 N. 8th St., PHILA. 40, PENNA.**

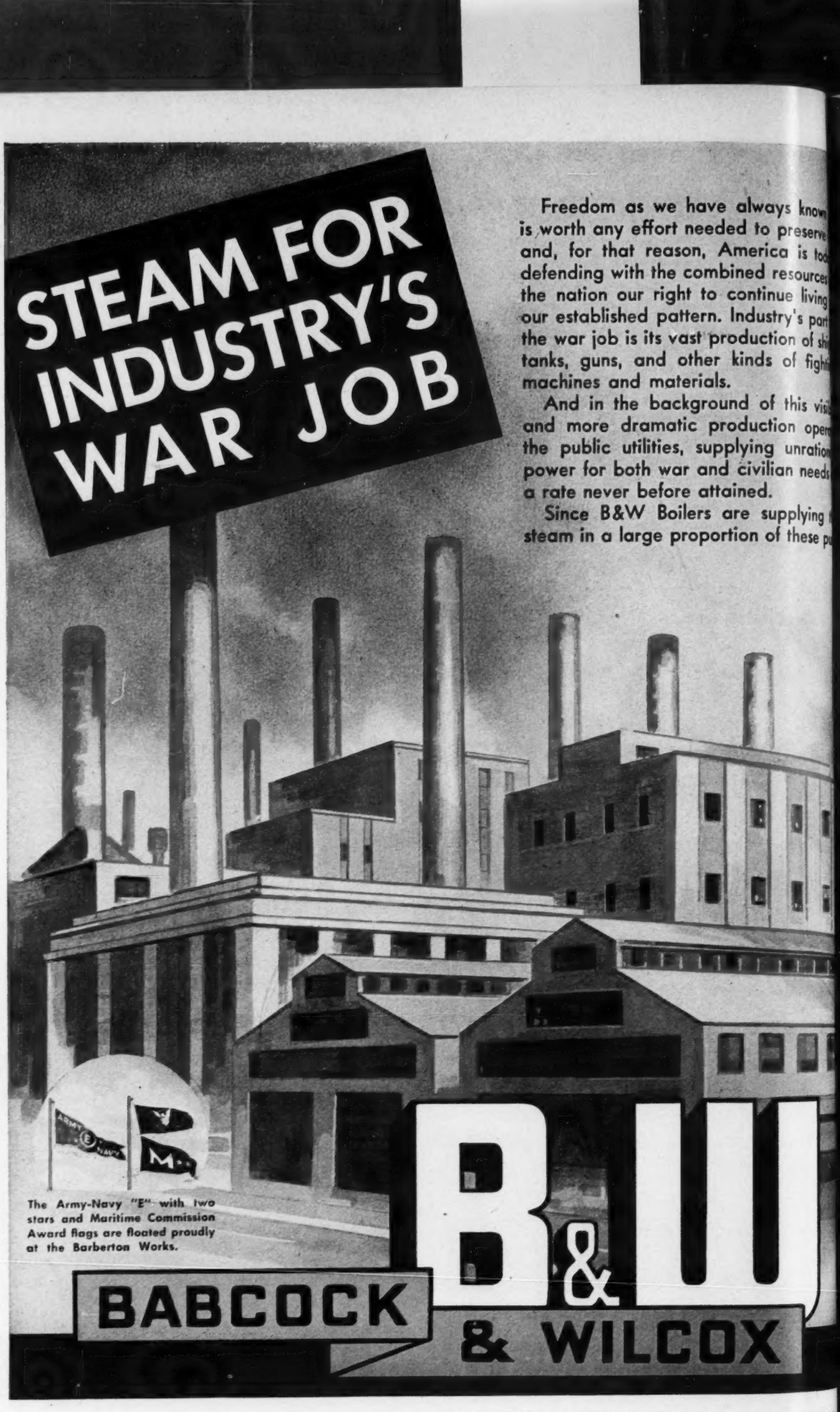


# STEAM FOR INDUSTRY'S WAR JOB

Freedom as we have always known
is worth any effort needed to preserve
and, for that reason, America is tod
defending with the combined resources
the nation our right to continue living
our established pattern. Industry's part
the war job is its vast production of shi
tanks, guns, and other kinds of fight
machines and materials.

And in the background of this visi
and more dramatic production opera
the public utilities, supplying unration
power for both war and civilian needs
a rate never before attained.

Since B&W Boilers are supplying
steam in a large proportion of these p

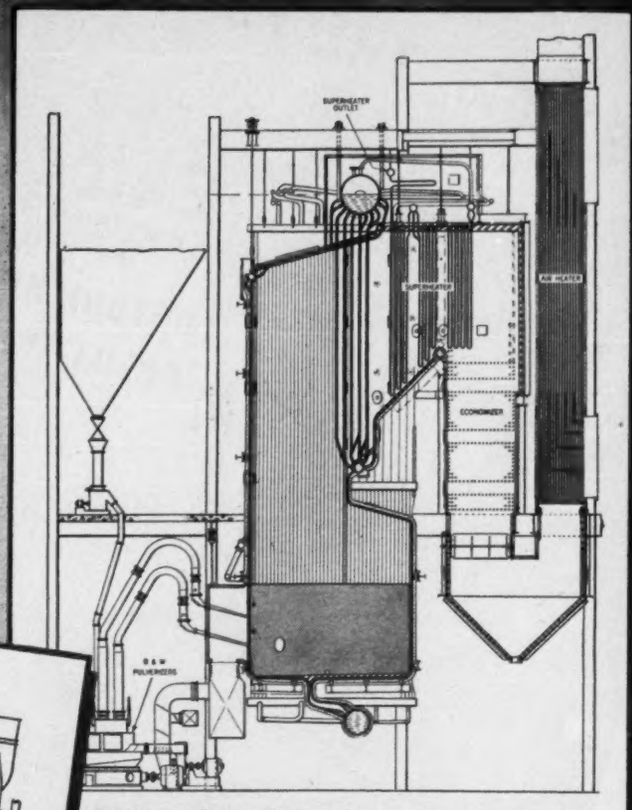


The Army-Navy "E" with two stars and Maritime Commission Award flags are floated proudly at the Barberton Works.

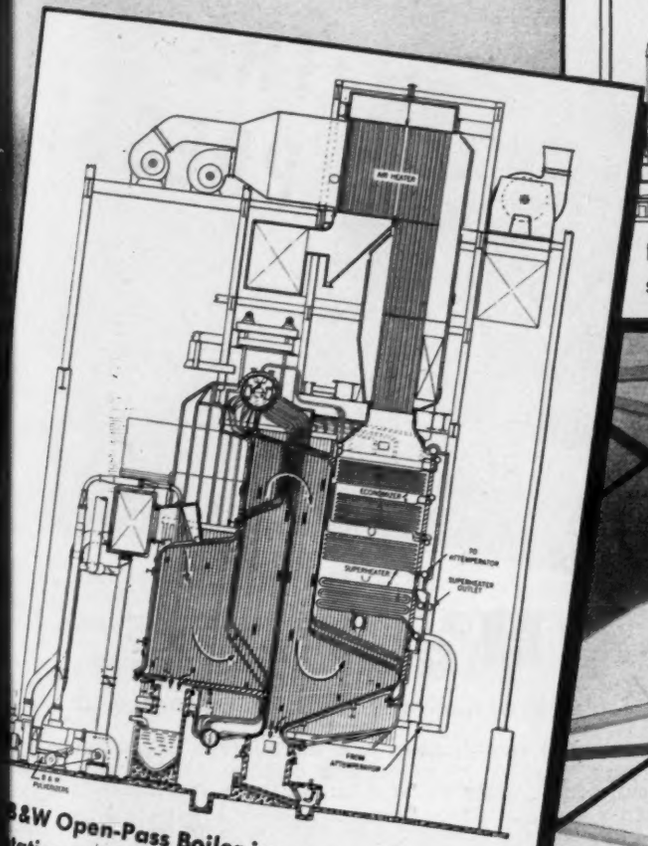
BABCOCK & WILCOX

B&W

utility and industrial power plants, and
r propelling naval and cargo ships, B&W
playing a substantial part in this great
ar effort. B&W engineering and pro-
uction skill have built into its boilers the
amina to endure today's gruelling drive.
With today's accelerated experience
elding more complete answers to such
roblems as behavior of metals at high
mperatures, action of fuels in slag-tap
nd dry-ash furnaces, circulation in high-
apacity high-pressure boilers, separation
steam from water in boiler steam drums,
nd other related problems, the boilers of
morrow should be even better able to
rve industry.




**B&W Radiant Boiler in an eastern central station—Capacity 400,000 lb. steam per hr.**




**B&W Open-Pass Boiler in an eastern central station—Capacity 350,000 lb. steam per hr.**

THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET NEW YORK 6, N. Y. G-254

JUST OFF THE PRESS!

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JUST OFF THE PRESS!

Exide
CHLORIDE
BATTERIES

Exide makes several types of storage batteries for control bus operation, the most popular of which is the Exide-Chloride Battery. Exide-Chlorides have earned the confidence of engineers everywhere, and, their widespread use in public utilities and private industrial plants is proof of their dependability.

HERE is a new booklet, prepared by Exide Engineers, containing factual information of interest to all engineers engaged in the application of switch gear. The installation of storage batteries in power stations and substations has become standard engineering practice, and this booklet tells how to attain adequate and uninterrupted current supply. Types of batteries . . . selection of battery . . . method of operation . . . maintenance and charging . . . and many other points are discussed completely in the new Exide Booklet. If you want to know more about batteries as an auxiliary source of electric energy, write for a FREE copy today.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

# Comfort by the carton

*B. F. Goodrich Anode electricians' gloves are easy to work in*

A LOT of electric linemen already know that they can be comfortable at work. But there are still many who wear old-fashioned electricians' gloves — the kind made by repeatedly dipping hand-shaped forms in a rubber solution, building up layers until the required thickness is obtained. The layers have a stiffening effect, and the stiffish fingers make more difficult a job that is awkward at best — particularly when leather gloves have to be worn over the rubber ones.

The first real improvement in electricians' gloves came when B. F. Goodrich developed the Anode process by means of which rubber of just the right thickness is deposited on forms with a *single* dipping. Those gloves shown in the picture being packed for shipment will be comfortable to work in because there aren't any layers of rubber to make them stiff.

But there's another reason for their comfort. B. F. Goodrich research men studied human hands; hands at work and hands relaxed. From their studies they designed forms for making gloves with scientifically *curved* fingers to *fit* a man's hand. The combination of curved-finger forms and the Anode process results in gloves that surprise even hard-boiled linemen because work is actually made easier.

The B. F. Goodrich distributor near you will be glad to show you how these gloves promote safety and comfort. Call him, or write *The B. F. Goodrich Co., Industrial Products Division, Akron, Ohio.*

**B. F. Goodrich**
**Electricians' Gloves**

# Another "Flat-Top" Scratched

## ...and Another Contact Problem solved by Mallory Engineering

It takes skill and nerve to sink an enemy vessel. But it also takes a good electrical relay—with the best contacts it is possible to make. Without such a relay, equipped with such contacts, deadly torpedoes could never be launched.

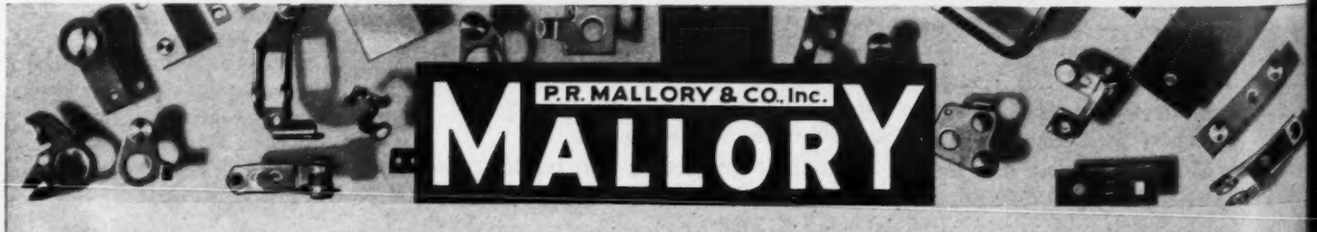
Consider these specifications, recently entrusted to Mallory engineers—specifications for a new type of torpedo bomber relay contact: Contacts to carry 25 amperes current of 29 volts DC, and to "make and break contact" once every second for 10,000 operations . . . the same contacts to carry an overload of 50 amperes at 24 volts DC for 100 operations, and to show no more than a 0.10 drop in voltage with 25 amperes.

The design prevented brazing the contact into the assembly. To avoid this factor, Mallory engineers developed a new powdered metal. This metal, Mallory D-52, met the electrical requirements and was sufficiently ductile to be made as solid rivets that could be easily staked or spun into the assembly.

Mallory solved this problem as it has many others, and the knowledge thus gained is still another additive of experience that's ready to be passed along to you. No one in the contact business has more all around "know how," or a more brilliant record for putting it to good use, than Mallory engineers. Why not put Mallory to work for *you?* Just send a drawing or description of the application you have in mind.

*Buy More War Bonds*

**P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA**




**ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES**
**NON FERROUS ALLOYS, POWDERED METAL PARTS**

FOR LASTING, DEPENDABLE SERVICE...

# rely on these 6 advantages of Transite Ducts

**Inorganic** . . . made of an asbestos and cement composition compressed under great pressure. This provides permanence and strength. These ducts are also immune to rust and rot.

**Permanently smooth bore** . . . long cable pulls and replacements are made easier. Danger of damage to cables is minimized.

**Easily and quickly installed** . . . long, light-weight lengths and simple assembly method assure rapid, economical installation.

**Immune to electrolysis** . . . being entirely inorganic and non-metallic, these ducts are not affected by electrolysis or galvanic action.

**Lower cable temperatures** . . . an advantage resulting from a relatively high rate of heat dissipation.

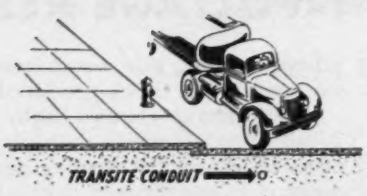
**Incombustible** . . . won't contribute to the formation of dangerous smoke, gases, or fumes. If burnouts do occur, these inorganic ducts provide maximum protection to adjacent cables and permit easy removal of damaged conductor.

For complete details on Transite Ducts, write for Data Book, DS-410, Johns-Manville, 22 East 40th Street, New York 16, N. Y.

JM PRODUCTS

## JOHNS-MANVILLE *TRANSITE DUCTS*

### TRANSITE *CONDUIT*




Designed for exposed work and for use underground without a concrete encasement.

### TRANSITE *KORDUCT*

For use in concrete. Thinner walled, otherwise identical with Transite Conduit.

## RATING DATA

**Voltage and Wattage Ratings:—**

**TYPE 1**

| Resistance Value | Maximum Wattage Rating | R.M.S. Voltage Rating |
|---|---|---|
| Up to 1.9 megohms | 12 watts | based on wattage |
| 2.0 to 10 megohms | 9 watts | 9 kv. max. |
| Above 10 megohms | based on voltage | 10 kv. max. |

**TYPE 2**

| Resistance Value | Maximum Wattage Rating | R.M.S. Voltage Rating |
|---|---|---|
| Up to 3.9 megohms | 22 watts | based on wattage |
| 4.0 to 20 megohms | 15 watts | 15 kv. max. |
| Above 20 megohms | based on voltage | 20 kv. max. |

**Temperature Rating:—**
Maximum recommended hot spot temperature for continuous operation: 130°C (Ambient plus rise).
Maximum recommended ambient temperature for full wattage ratings: 70°C.

**Temperature Coefficient:—**
Approximately .04% per degree C between 20°C and 130°C.

**Resistance Tolerance:—**
Minimum acceptable tolerance ±10%.

**Construction:—**
(a) Hermetically-sealed to withstand salt water immersion tests.

(b) Designed to withstand aircraft vibration and 10g acceleration tests.

**A problem solved, designed, and produced in ninety days—and made possible by longstanding research and experience.**

**TYPE 1**
**5-9/32" x 1-1/16"**
**3600 ohms to**
**100 megohms**

**TYPE 2**
**9-25/32" x 1-1/16"**
**6800 ohms to**
**100 megohms**

# SPRAGUE MEG-O-MAX
## HIGH-RESISTANCE, HIGH-VOLTAGE RESISTORS

Less than 3 months from the presentation to Sprague Koolohm Resistor engineers of the problem of designing high-resistance value units capable of dissipating power at voltages up to 20 kv. and at high ambient temperatures, the first Sprague Meg-O-Max Resistors were on the job! Moreover, they used practically no critical materials, were of smaller physical size, and presented a degree of resistance stability and mechanical ruggedness not available in other units, exclusive of costly wire-wound meter multiplier types!

Entirely unique in construction, Meg-O-Max Resistors are formed of a series of molded segments. These are joined non-inductively, and the assembly is then encased in a hermetically-sealed, rugged glass envelope provided with ferrule terminals to withstand aircraft vibration tests, salt water immersion tests, and tests for mechanical shock produced by rapid acceleration.

In addition to use as a high-voltage bleeder and as a broad accuracy meter multiplier for a voltage indicator, Meg-O-Max Resistors find many applications in measuring instruments, rectifier systems, high-voltage dividers, and as broad accuracy meter multipliers. Specify Meg-O-Max for High-Resistance—High-Voltage requirements.

Data sheets gladly sent upon request. Samples sent only on firm's request, giving details of application.

**SPRAGUE SPECIALTIES COMPANY**
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**A NEW DEVELOPMENT BY THE MAKERS OF KOOLOHM TRADEMARK REGISTERED INSULATED WIRE-WOUND RESISTOR**

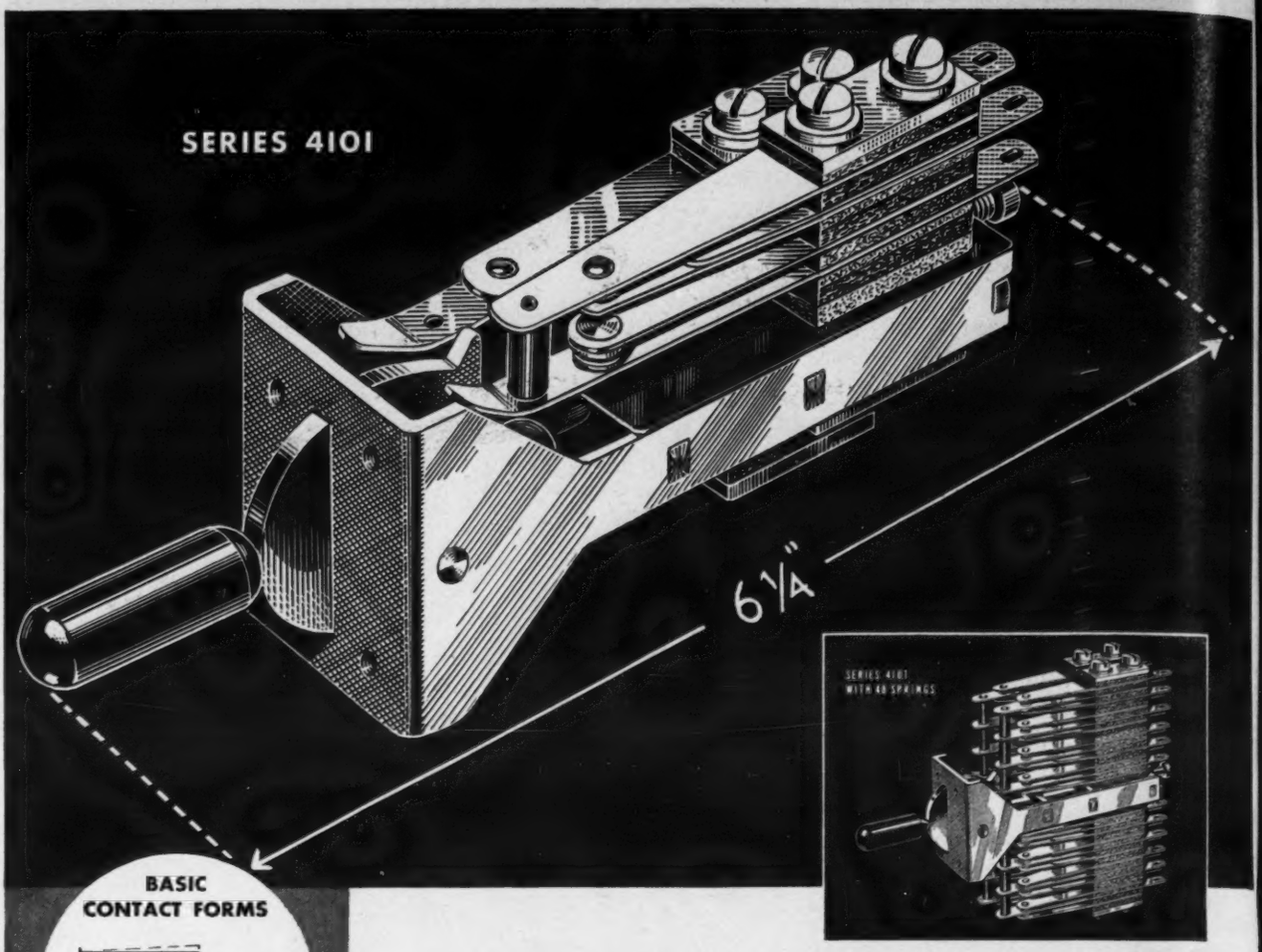
T'S THE *PORCELAIN* THAT INSULATES

## THESE AIR BUBBLES WILL NEVER SPOIL AN INSULATOR

Pictured here is visible evidence that Lapp Vacuum Process does its job. Bubbling through this tank of water is the air expelled from the liquid clay, as it passes through the vacuum slip treatment. Many of the porcelains in routine Lapp production are possible of manufacture only because of the superior quality of clay produced by Vacuum Process. In conventional types of insulators this superior porcelain is a Lapp plus, an extra factor guaranteeing mechanical and electrical integrity. We'll welcome the opportunity to tell you just why we think Lapp Insulators will perform better on your lines. Lapp Insulator Co., Inc., Le Roy, N. Y.

# Lapp

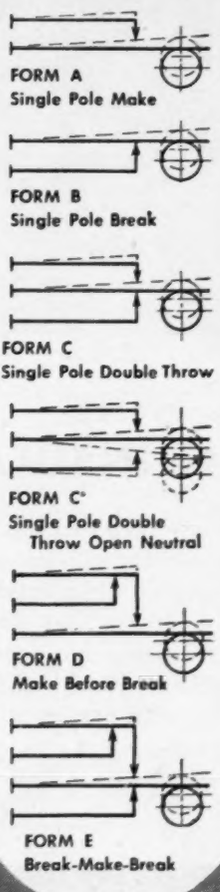
*Better Porcelain • Better Insulators*







**BASIC CONTACT FORMS**




## PRACTICALLY UNLIMITED CIRCUIT ARRANGEMENTS WITH

# Mossman 4101 Heavy Duty Lever Switch

Demand for the Mossman 4101 Heavy Duty Lever Switch is increasing in the utility industry every day. This switch is meeting unusual specifications in an ever broadening field of applications, such as:

1. Indication in remote control or telemetering circuits.
2. Supervisory control circuits in load dispatching.
3. Communication control circuits in utility and industrial plants.
4. Testing and calibration in meter departments and for tube testing.

The Mossman 4101 Switch permits a versatile control setup of almost unlimited circuit arrangement, due to the fact that it can be supplied in combinations as high as 12 springs per pile-up, 24 springs per position, or 48 springs total. It can also be furnished, for specific applications, in any combination of the six basic contact forms shown here.

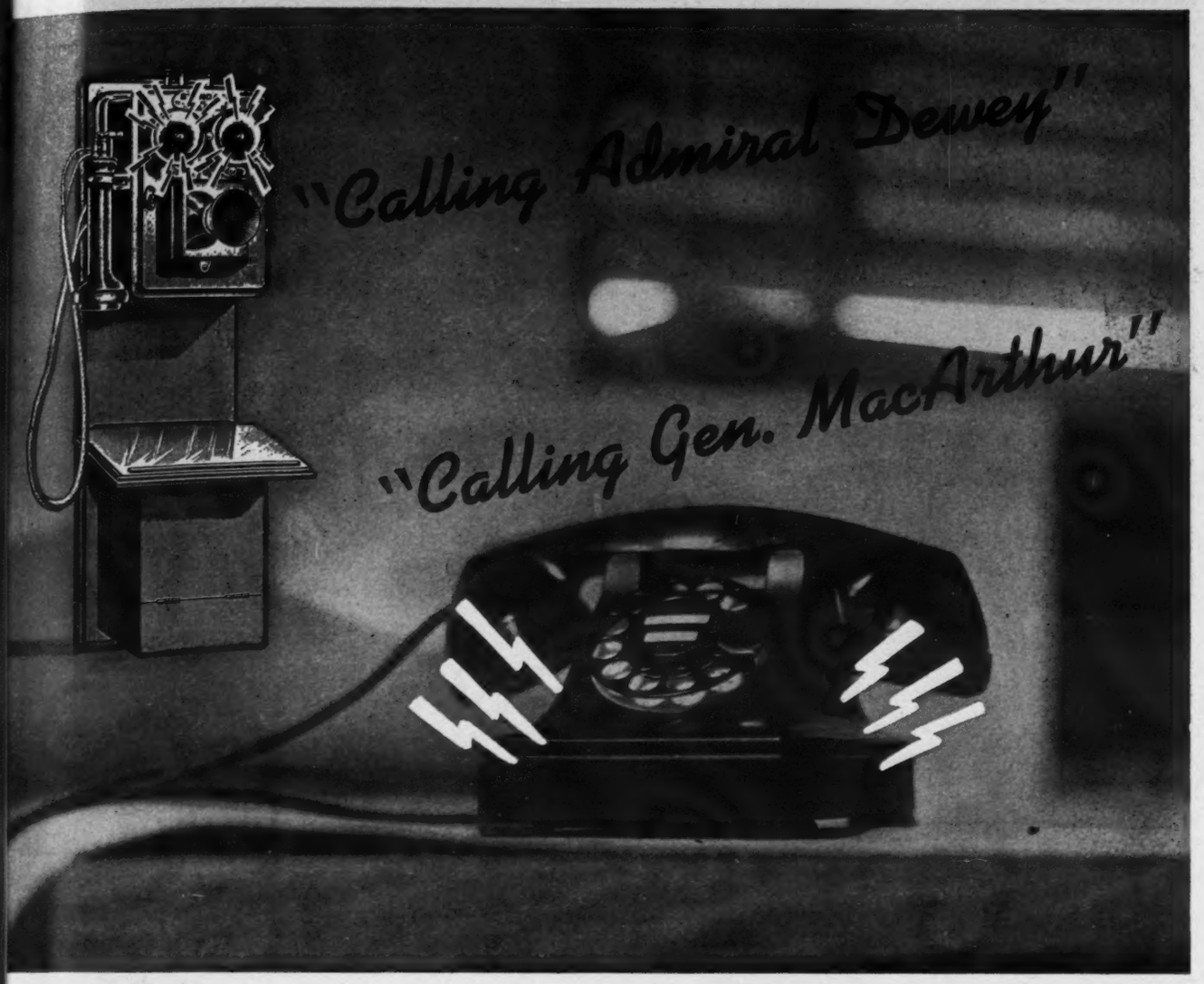
Standard heavy duty contacts are of 3-16" diameter, fine silver rated at 10 amperes, 110 volts, A.C., non-inductive. Extra heavy duty contacts are of 5-16" silver alloy rated at 20 amperes, 110 volts, A.C., non-inductive. Breakdown rating of springs to ground is 2000 volts—alternating current.

Write for our new catalog, which pictures and describes the 4101 Switch, and the full line of Mossman precision electrical components, including many types of heavy duty, multiple circuit lever switches, turn switches, push switches, plug jacks and special switching components.

**DONALD P. MOSSMAN, INC., 6133 N. Northwest Highway, Chicago (31), Illinois**

# MOSSMAN

## "Electrical Components"




# C-D INSULATION *helped complete both calls . . . . . .*

BETWEEN that wall-hung "stem winder" and today's radio telephony, America's best technical minds have made the telephone as vital an instrument of war as it is of peace . . . With its development and world-wide use, CONTINENTAL-DIAMOND has been closely associated from the very beginning — always ready with the kind of insulating materials that would promote long distance efficiency and simplify instrument design.

When conditions permit your phone company to put their post war plans and designs into effect you will find that new and better C-D insulation has again aided in the never-ending search for perfect service.

Our Research Laboratory and its staff of Electrical and Insulating Engineers is at your disposal for the development of things to come. Write us without thought of obligation.

**Continental-Diamond FIBRE COMPANY**

*Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE*

# End of an Enemy

In a split second this enemy plane will be blasted from the skies by a shell from one of our anti-aircraft guns on the ground.

How can a gun hit a plane going 300 miles an hour 20,000 feet up . . . when it takes the shell 15 seconds to get up there and in that time the plane has gone more than a mile? Besides, the shell curves in its flight. Wind blows it. Gravity pulls on it. Even the weather affects its velocity.

The answer is the Gun Director—an *electrical* brain which aims the guns. Swiftly it plots the plane's height and course. Instantly it solves the complex mathematical problem, continuously matching the curved path of the shell to the path of the plane so that the two will meet. It even times the fuse to explode the shell at the exact instant.

The *electrical* Gun Director has greatly increased the deadliness of anti-aircraft gunfire. Developed by Bell Telephone Laboratories and made by Western Electric, it is one of many war weapons now being produced by the peacetime makers of Bell Telephones.

*Until the last enemy plane is knocked down,*
*buy War Bonds regularly—all you can!*

**Western Electric**

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

Like Giants in single file
THEY look like giants, these Blaw-Knox Transmission Towers, striding single file across the landscape.
They are giants; for in their grip of steel is power for a thousand mills. Utility engineers around the world have long appreciated — in Blaw-Knox towers — the strength and durability and scientific design that make for efficient and economical operation.
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TO KEEP AWAY FROM RUST
TO KEEP WIRING SAFE
UNDERWRITERS' LABORATORIES INC. LABORATORY INSPECTED RIGID STEEL CONDUIT
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National Electric Products Corp.
Pittsburgh, Pa.

# Milestones

Along the path of accomplishment of every industry there are significant marks that, like milestones, indicate how far the industry has come. Last year several such milestones were set out by the electric utility industry, as disclosed in our annual statistical number. Some of these new milestones are the passing for the first time of

- 200 billion kilowatt-hour output
- 100 billion-kilowatt hour sales to any one customer classification (large light and power)
- 2 billion kilowatt-hour input to REA systems
- $3 billion in revenue from energy sales
- $1 billion revenue from any customer class (residential and municipal and miscellaneous)
- Average capacity use of more than half the hours in the year
- Average fuel capacity use of more than 4,000 hours in a year
- Taxes of over 25 cents out of each dollar

This year will see other milestones passing by, such as

- Capacity passing the 50 million-kilowatt mark
- Sales passing 200 billion kilowatt-hours
- $40 average residential customer bill
- 20 percent of generating capacity publicly owned

Each succeeding year will in all probability continue to set up some new milestones in some part of the industry's operations, and it is this very fact that is our assurance that the 1943 war record is not just a flash in the pan.

Electric service is moving faster than the economy of the country. Compare the index of electrical usage with two of the country's best indexes and we find: The Federal Reserve Board index of production (1925=100) stood at the end of last year at 267. The Business Week Index of Business Activity (1923-1925=100) stood at the end of the year at 241.6.

Electricity usage index (annual kilowatt-hour sales) stood at 370.

In other words, although electricity enters into virtually every phase of business activity, its usage is not a good barometer of American economy because it still has the capacity to grow faster than general business. This capacity to expand faster than the nation is the reason why milestones have been flashing by year after year and will continue.

America is still far from usage saturation even on the things known long before the war. Out of the practices of the war will come many new things so that the opportunity for expansion in electric energy use is greater today than it was before Pearl Harbor. No one questions the fact that there will be load mortality, some of which will be serious, but there will also be new loads that will be far greater than any that will be lost as the result of improved efficiency or competition.

It is not necessary to know what these loads will be to have the vision of at least several years of great expansion in the electric utility industry. In fact, that very vision may inspire the creativeness and research that will bring new loads. Certainly it has been demonstrated enough times in other places that a goal based on vision and confidence can achieve a whole lot more than no goal at all.

Let us then look once more at the milestones we have just passed and ask ourselves what milestones we want to reach by the half-century mark in 1950. And let that be our goal.

# Efficiency—Range Is Aim of Bayside Extension Design

***New 30,000-kw. addition at Bayside station of the Wisconsin Public Service Corporation designed to give high efficiency over wide load range for operation in parallel with hydro stations***

***W. F. NELSON, Fuel Engineer, Wisconsin Public Service Corporation, Green Bay, Wis.***

EARLY in 1940 growth in power system requirements indicated the need for a substantial increase in generating capacity on the Wisconsin Public Service Corporation system. There were no hydro sites available that could be developed to give the necessary firm capacity. Furthermore, the purchase of firm power through interconnection with other utilities was neither practical nor economical. Consequently, it was decided to obtain the additional capacity by installing steam-generating equipment.

Since water-borne coal was available at Green Bay and also because studies indicated that the capacity was needed in the Green Bay area, it was decided to add a 30,000-kw. unit to the Bayside steam station.

Load that Bayside station will be asked to carry will fluctuate over a wide range, depending on water conditions at various hydro stations. It was important, therefore, that the new unit have a high availability. Design of this addition was influenced by this requirement and the need for high efficiency over a wide range of load (Fig. 1). An attempt was made to meet these needs without introducing complications that would add to operating difficulties.

### *Boiler Design*

The steam-generating unit is a radiant-type, water-tube boiler, with a continuous-tube, convection-type superheater and submerged attemperator, and includes a water-cooled, hopper-bottom furnace. The boiler is designed to deliver 312,500 lb. of steam per hour at 675 lb. psi. and 900 deg. F. at the superheater outlet. The furnace is designed for a maximum heat release of 20,700 B.t.u. per cu.ft. of furnace volume.

Full capacity can be obtained from the boiler when burning coal having 11,200 B.t.u. per lb., commercial, and a total moisture of 11.4 percent, of which 5 percent is surface moisture. The boiler will handle coal having an ash softening point of 2,100 deg. F. Guaranteed efficiency is 86.3 percent at maximum rating.

### *Steam Temperature Control*

Since the unit is to operate over a wide range of load it is important to

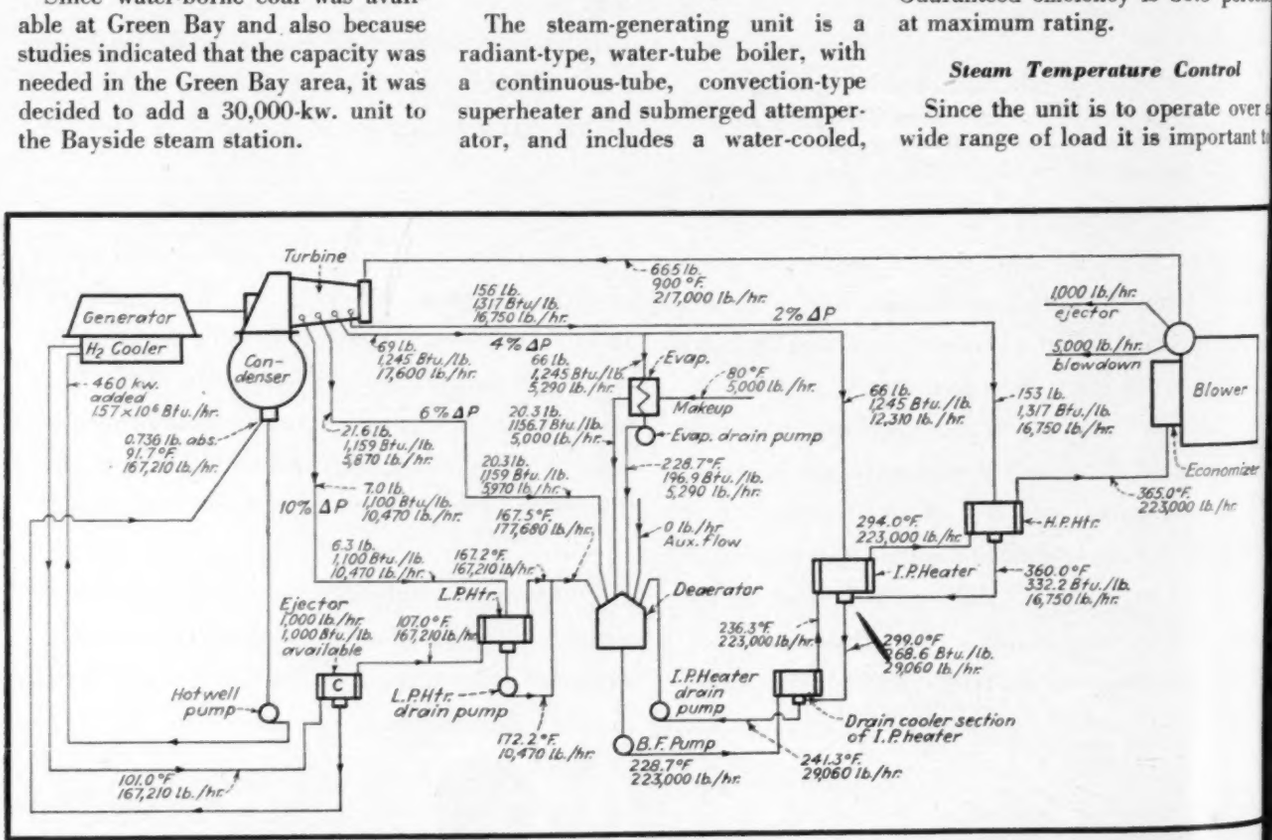



**FIG. 1—Heat balance for the 25,000-kw. load condition of 30,000-kw. addition**

hold final steam temperature as constant as possible over this range, to avoid undue stresses in the steam turbine and appurtenances. This was done by using a submerged attemperator (Fig. 2), which is a comparatively new means of controlling total steam temperature (Fig. 3) over a wide load range. The attemperator, located outside of the boiler and between the first and second sections of the superheater, consists roughly of a heat-exchanger shell, with a loop bundle of tubes submerged in boiler water. All steam from the first section of the superheater goes to the head of the attemperator, where a butterfly valve diverts some of it through the tubes, or bypasses them, depending upon the final steam temperature. The butterfly valve is positioned by an automatic temperature control mechanism actuated by a temperature bulb in the steam outlet header of the superheater.

Pulverized fuel is provided by two-unit ball mills designed to furnish sufficient fuel to generate full boiler capacity when burning coal having 11,200 B.t.u. per pound as received. Fuel from each mill is removed by an exhaustor and fed to horizontal in-vane burners. In order to handle the varying load conditions efficiently all four burners are equipped with low-capacity nozzles for operation at low loads.

Air to the boiler is supplied by one forced-draft fan, driven by a motor through an electric coupling. Gases pass through a Ljungstrom air preheater to the induced-draft fan, similarly driven. The electric couplings on both forced- and induced-draft fans give close control over a wide range of loads.

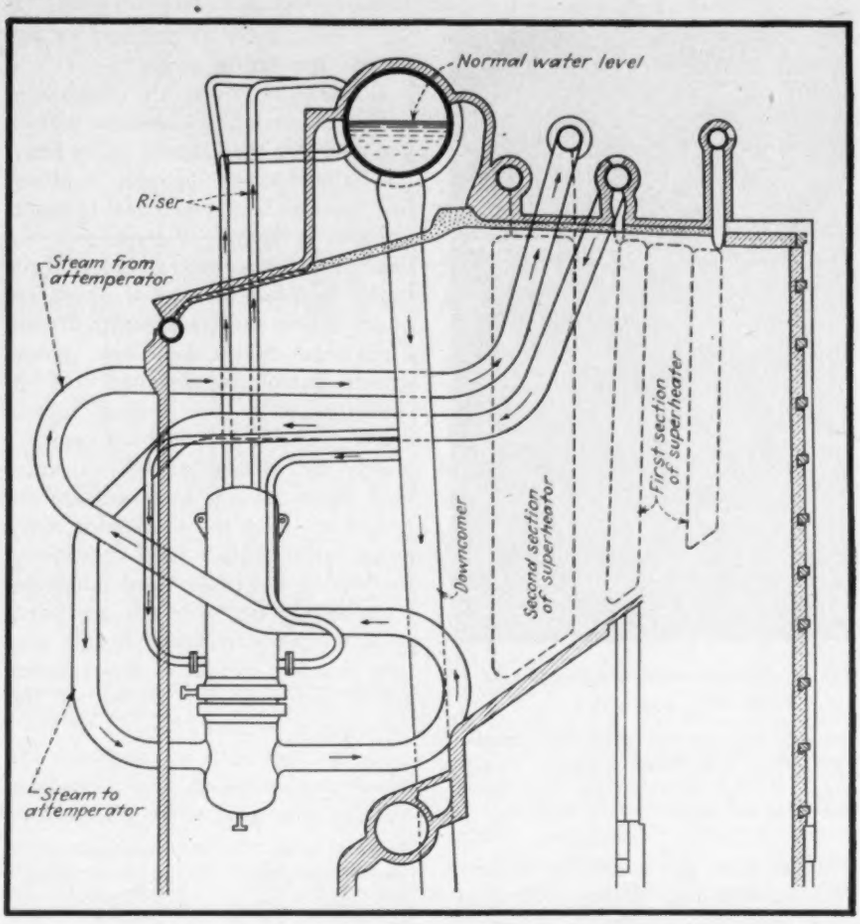



FIG. 2—Submerged attemperator between two stages of superheat has butterfly valve which bypasses steam to hold superheat temperature constant above half-load

### *Interlocks Protect Boiler*

To eliminate the possibility of pulverized fuel being fed into the boiler if either the forced-draft or induced-draft fan should fail the motors driving the various pieces of equipment are electrically interlocked (Fig. 4). The induced-draft fan, forced-draft fan, exhauster, pulverizer and feeder motors are connected electrically so that one unit cannot be started unless the unit ahead of it is running. They must be started in the order given above. Since the induced- and forced-draft fans have electric couplings, the interlocking has to be initiated from the electrical coupling rather than the a.c. fan motor. Should the induced-draft fan fail the interlock will take out the forced-draft fan, exhauster, pulverizer and feeder motors. If the exhauster should fail, the pulverizer and the feeder motor are taken out of service through the interlock, but the induced- and forced-draft fan will remain on.

Included in the boiler protection system is a purge interlock, which makes it impossible to start the pulverizer, exhauster or feeder until the induced-draft fan and forced-draft fan have been in operation and the air passes through the boiler for a definite length of time. This purge interlock is actuated on the pressure drop through the gas passages of the boiler and has a time-delay device to insure that the boiler has been completely purged of any combustible matter before the pulverizer and exhauster can be operated. If proper flow of air has been obtained for the predetermined length of time the purge interlock operates a relay in the exhauster circuit, which allows it to be put into operation.

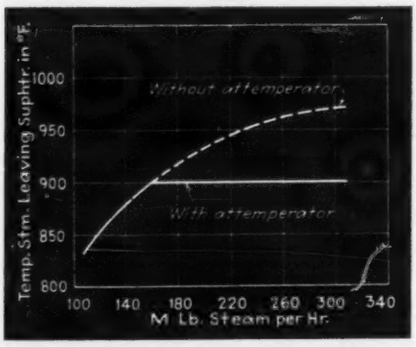



FIG. 3—Attemperator holds steam temperature leaving superheater constant at 900 F. in boiler load range above 160,000 lb. per hour

The turbo-generator is a tandem-compound unit having a main and a pilot exciter direct connected. It is rated at 30,000 kw. when operating at 84 percent power factor. Operating speed is 3,600 r.p.m. and the generated voltage is 14,000. The unit is equipped with a turning gear.

There are four bleed points for feedwater heating and evaporation of make-up water. Hydrogen cooling is used that is capable of absorbing 1,-

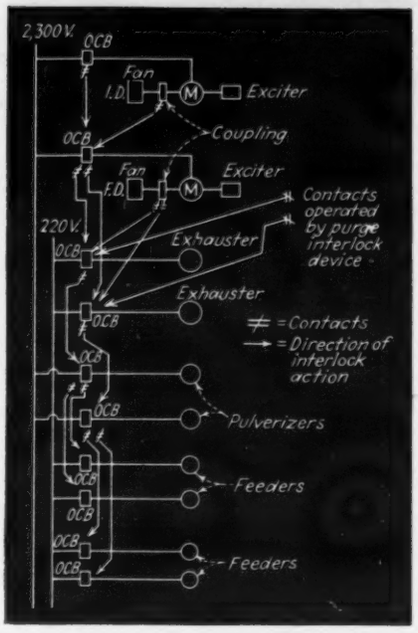



**FIG. 4—Diagrammatic arrangement of interlocks on boiler auxiliaries**

**Contacts on induced draft fan coupling close on electrical failure in electric coupling circuit; breaker contacts close when breaker opens for any reason**

670,000 B.t.u. per hour. Use is made of a vacuum trip device, with lead-diaphragm type explosion doors, in the low-pressure casing, rather than the conventional type of atmospheric relief valve. This eliminates considerable unsightly piping and should be a very reliable safety feature.

If for any reason the unit trips out from overspeed it will also actuate the trip coil on the generator breaker. The reason for opening the machine breaker is to prevent hydro turbines from carrying the steam turbine to dangerous speed on loss of load.

### *Condensing Water*

Circulating water for the condenser is furnished by two vertical self-priming pumps, one having 60 percent capacity and the other 40 percent capacity. Considerable power saving is expected with this set-up of circulating water pumps as it will be possible to take advantage of the smaller capacity requirements during light loads and during the winter months when the cooling water is low in temperature. The proportioning of these pumps also has advantage from a reliability standpoint which will be explained later. Air is removed from the condenser with a tube jet vacuum pump having three sets of two-stage nozzles, which are arranged so that any combination of primary or secondary jets can be used.

Condensate from the condenser passes through the generator hydrogen cooler to the vacuum pump inter- and after-coolers through a closed low-pressure heater and into a deaerating type heater. Water from the deaerating heater goes to one of three boiler feed pumps, two of which are motor driven and one is steam driven. The steam-driven and one motor-driven pump are designed for full capacity, while the second motor-driven pump is designed for approximately 60 percent of full capacity. Here again savings in power are expected by using the smaller capacity pump under certain load conditions. On leaving the boiler feed pump the feedwater passes through an intermediate pressure-closed heater and then to a high-pressure closed heater before entering the boiler at the economizer section.

In the operation of the boiler the following limits of water analysis were set as a goal to be maintained:

| | |
|---|---|
| Dissolved solids | <20 parts per 100,000 |
| Phosphate as $PO_4$ | 1-3 parts per 100,000 |
| Sulfite as $Na_2SO_3$ | 2-3 parts per 100,000 |
| Hydroxide as NaOH | 2-5 parts per 100,000 |
| Silica as $SiO_2$ | <1.6 |
| Embrittlement Ratio | >2.5 |
| pH | 10.9-11.1 |
| Dissolved $O_2$ | <.03 ml./L. |
| Suspended matter | Minimum |

These boiler water conditions are accomplished by the feeding of sodium phosphates (mono, di, tri), sodium sulfate, sodium hydroxide and sodium sulfite. The dosage of chemicals will be relatively small inasmuch as evaporated water will be used and make-up will be small. The chemicals are dissolved in water and fed directly to the boiler drum by means of a chemical feed pump. The economizer is not protected against corrosion by this method, except by the natural pH of the feedwater, which in this case is sufficiently high.

It was necessary to add two additional traveling water screens and to enlarge the screenhouse. Chlorinating equipment has been installed with sufficient capacity to chlorinate the water to be used for the new unit as well as existing units. Chlorinating equipment is housed adjacent to the screenhouse and the chlorine will be injected into the water system at the discharge of the traveling water screens.

### *Electrical Connections*

Main electrical connections for the existing plant are relatively simple, consisting merely of a simple 14-kv. bus, to which the two present 10,000-kw. generators are connected. Power from this bus is stepped up from 14 kv. to 66 kv. through a 28,125-kva. bank of transformers. These transformers are connected on the high side to the main 66-kv. bus in the substation, at which point the output of the plant is introduced into the high-voltage system. The single 66-kv. bus forms part of the 66-kv. ring surrounding the city of Green Bay and nearby DePere and is in the nature of a long 66-kv. bus sectionalized at several points and from which power is sent out or received.

Connections for the new 30,000-kw.

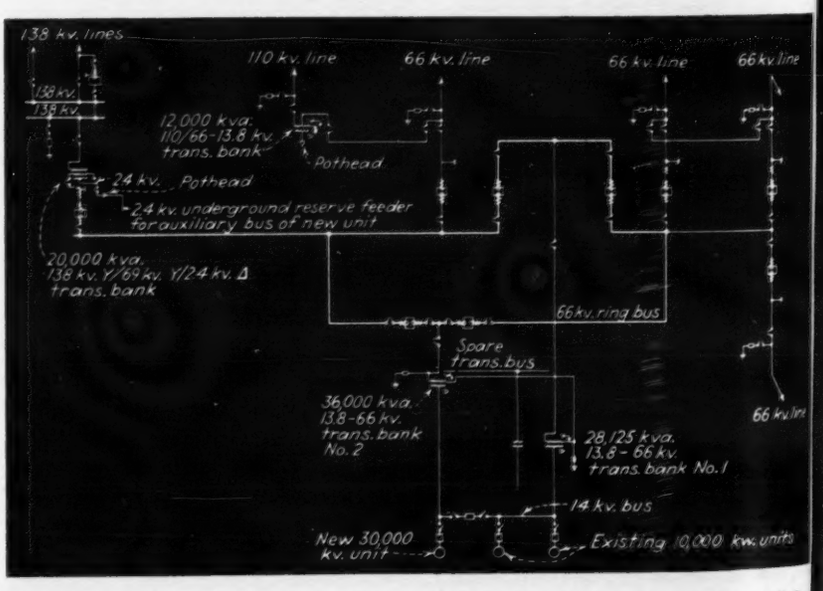

138 kv. lines
110 kv. line
66 kv. line
66 kv. line
66 kv. line
138 kv.
138 kv.
12,000 kva. 110/66-13.8 kv. trans. bank
Pothead
24 kv.
Pothead
24 kv. underground reserve feeder for auxiliary bus of new unit
20,000 kva. 138 kv. Y/69 kv. Y/24 kv. Δ trans. bank
66 kv. ring bus
Spare trans. bus
36,000 kva. 13.8-66 kv. trans. bank No. 2
28,125 kva. 13.8-66 kv. trans. bank No. 1
66 kv. line
14 kv. bus
New 30,000 kv. unit
Existing 10,000 kw. units

**FIG. 5—New and existing units feed into 66-kv. ring around Green Bay and DePere**

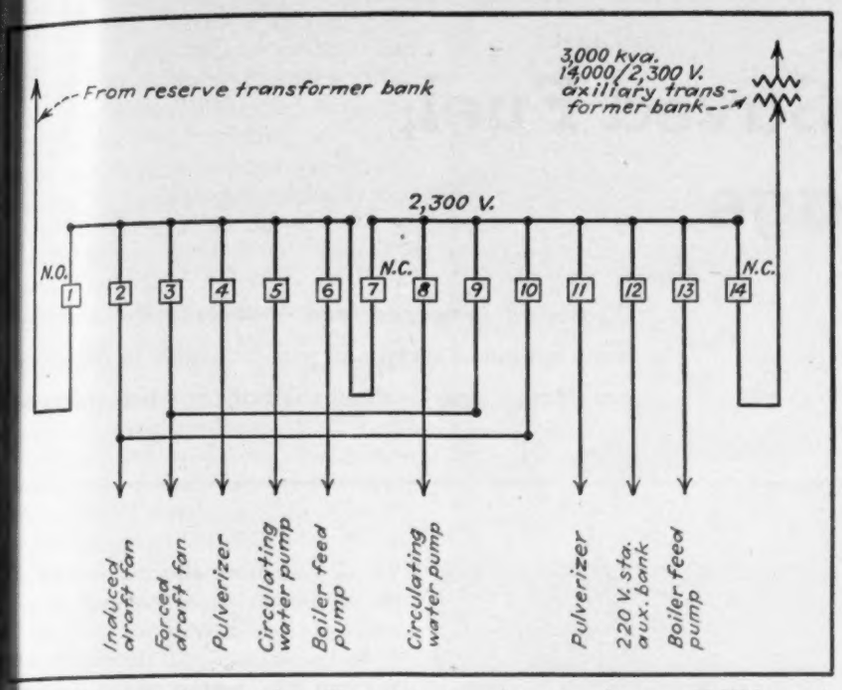



FIG. 6—Schematic diagram of auxiliary power supply system for new 30,000-kw. unit

ddition to the Bayside plant is also elatively simple. There is a main 14-v. bus from which the generator is onnected, and this bus will be con-ected to the old 14-kv. bus through tie switch. Power from the new bus stepped up from 14 kv. to 66 kv. hrough a 36,000-kva. bank. These ransformers are connected to the ain 66-kv. bus and form a two-sec-ion ring bus.

The accompanying circuit diagram hows the connections for this ring us and how the units are connected n. The existing plant is connected nto the bus at one junction point Fig. 5) and the new addition is con-ected in at the other junction point, ith a breaker installed on either side the junction points. The two sec-ons of the bus are differentially pro-cted so that if one section of the ring ts into trouble the generator will ay connected to the other section.

The 66-kv. loop around Green Bay d DePere, as well as other loops eding locations having two sources supply, can be fed from either side the two-section ring bus. Lines ading away from the ring bus are otected by means of pilot wire re-ys or high-speed distance type re-ys.

### *Auxiliary Set-up*

Wherever possible, important sta-n auxiliaries have been split up o two units, and these auxiliaries have been connected to the station power (Fig. 6) so that a failure of any one section of the bus will not cause a complete shutdown of the generating unit. Some of the major auxiliaries, however, are not duplicated, such as the single induced-draft fan and the single forced-draft fan. These important single-unit auxiliaries are connected to both sides of the station bus. Should one side of the bus get into trouble, they will automatically be thrown over to the other side.

### *Fan Motors*

Induced- and forced-draft fans are normally connected to the station auxiliary bus through breakers 9 and 10. Breaker 1 is normally open and breaker 7 and 14 normally closed. In the event that the right-hand side of the bus gets into trouble, breakers 2 and 3 will close after breaker 7 and 14 have opened. Breakers 9 and 10 will open after 2 and 3 have closed, and 1 breaker will close after 9 and 10 breakers have opened. The section of bus in trouble will now have been cleared and the left hand side of the bus has been connected to the reserve supply, allowing operation on one pulverizer, one circulating water and one boiler feed pump, with the two forced-draft fans continuing to operate as before.

Certain 230-volt station auxiliaries that are just as important in the operation of the plant as the 2,300-volt auxiliaries mentioned have a similar throw-over arrangement so that their operation is assured.

The Bayside station extension was designed by the Public Utility Engineering & Service Corporation, Chicago, in co-operation with engineers of the Wisconsin Public Service Corporation.

•

## Materials Saved by Unit-Pole Lighting

Considerable savings in critical materials can be made for floodlighting outdoor areas by unit-pole installations. An example is shown in the illustration, which is at the plant of the American Bridge Company, Pittsburgh, Pa.

The particular installation consists of ten 1,500-watt, 115-volt lamps in standard outdoor type reflectors. Power is supplied by a 15-kva. transformer connected to the 2,300-volt distribution line of No. 6 wire. The lights are connected directly to the secondary terminals of the pole-mounted transformer.

A number of these installations are used in the plant yard and all are controlled by a single switch. Some of the poles, however, have only five floodlights, but each is complete with its own transformer. The pole-unit arrangement was designed by lighting engineers of the Duquesne Light Company.

UNIT-POLE installation for lighting saved critical materials

# Capacitors Saved Fuel, Raised Voltage

***Distributed pole-type and automatically switched units improved service to war industries in the southern Maine area — Plant capacity has been released***

TO CONSERVE fuel oil, coal and water and to improve voltage regulation on extended portions of its transmission and distribution system in the Portland district the then Cumberland County Power & Light Company, now the southern division of the Central Maine Power Company, purchased 15,000 kva. in capacitors in the spring of 1942. At the time the Cumberland utility had ten hydroelectric stations aggregating 38,687 kva. and two steam plants totaling 45,000 kva. There was also a two-circuit tie line between this company and Central Maine Power operating at 115 kv. with a 21,000-kva. transformer bank at the Portland terminus, and in June, 1942, a second transformer bank of 25,000 kva. was added.

The Cape station at Portland, burning fuel oil only, was rated at 28,125 kva. and the plant at Biddeford supplied the balance of steam power requirements. The latter had four small coal-burning boilers capable of supplying steam up to about one-half the generating facilities installed and a new oil-burning boiler with a steam production capacity about equal to the four units mentioned. This oil-burning boiler was shut down on account of the fuel oil shortage. Steam from the small coal-burning boilers was used for heating and process work in the Pepperell, York and Saco-Lowell manufacturing plants at Biddeford-Saco, the balance of steam produced being available for electric generation. This generation attained a value of 2,500 kw. in summer and about 1,000 kw. in winter, but the steam turbine equipment installed could be run on the coal-burning boilers to absorb about 7,000 rkva.

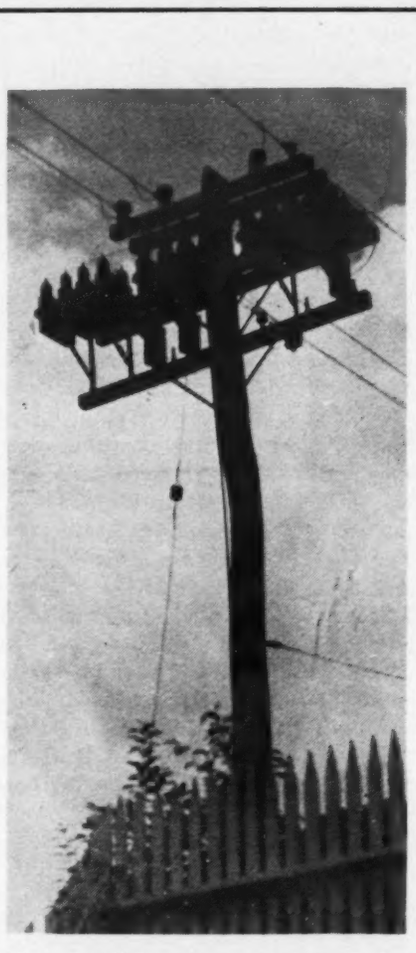


**FIG. 1—Pole-type capacitor group outside a factory served by 2,300-volt feeder**

The system load in the Portland area had been rapidly growing in the preceding year due to war production plants. The major part of the increase was due to the South Portland shipyards, which had added about 10,000 kva. in load and three oil pumping stations serving sections of the Portland-Montreal pipe line with a connected load of about 2,500 kva. In the area were also many machine shops, foundries, cotton and woolen mills engaged in war work.

In December, 1941, the energy output ran 35.7 percent above the year before and the one-hour peak was 56,200 kw., or 19.15 percent up from 1940. On April 27, 1942, at 11 a.m. the load was 47,350 kw., which was about 10 percent above the April, 1941, peak. Loads were still gaining in April, 1942, and the company anticipated a demand of between 7,300 and 9,300 kva. for shipyard, naval and pumping service in addition to existing loads. The April 27 load above cited corresponded to 68,000 kva. at a 68.5 percent power factor. At this time about 15,000 rkva. was being absorbed by the two steam plants operating as synchronous condensers, which brought the net system power factor to 80 percent.

### *Pre-Correction Fuel Losses*

In order to operate the two steam plants for corrective rkva. under the conditions it was necessary to burn fuel at both stations, coal at Biddeford and oil at the Cape. To enable the Cape station to absorb about 9,000 rkva. it was necessary to use at least 3,000 bbl. of fuel oil per month, and to enable the Biddeford station to absorb about 6,000 rkva. about 625 tons of coal per month was needed. Any increase in system load called for further supply of wattless current, with increased fuel consumption.

The above load conditions were observed at a time when there was sufficient water to run all the hydro plants at full capacity. However, with all hydros operating at low-flow kil-

watt output, it became necessary for the company to purchase 30,000 kw. from Central Maine Power to make up the system deficiency with the 47,350 kw. load of April 27, 1942. Central Maine could not supply this power at a satisfactory voltage with a power factor below 90 percent.

To secure this power factor it would have been necessary for Cumberland to make extensive use of its Cape station as a synchronous condenser and to run all its hydro plants at a very low power factor, representing a most inefficient use of water and a waste of oil and coal which could be greatly reduced or prevented entirely under certain conditions by the installation of 15,000 kva. in capacitors.

At one 9,000-kva. hydro plant, for example, it was necessary to run at least three of the six units in the station as synchronous motors to absorb wattless current under the above conditions, venting the water wheels. Another four-unit, 2,000-kva. hydro ran at 50 percent power factor. It was seen that the installation of capacitors on this system would take care of this waste and enable the company to utilize its generating capacity more effectively for energy production.

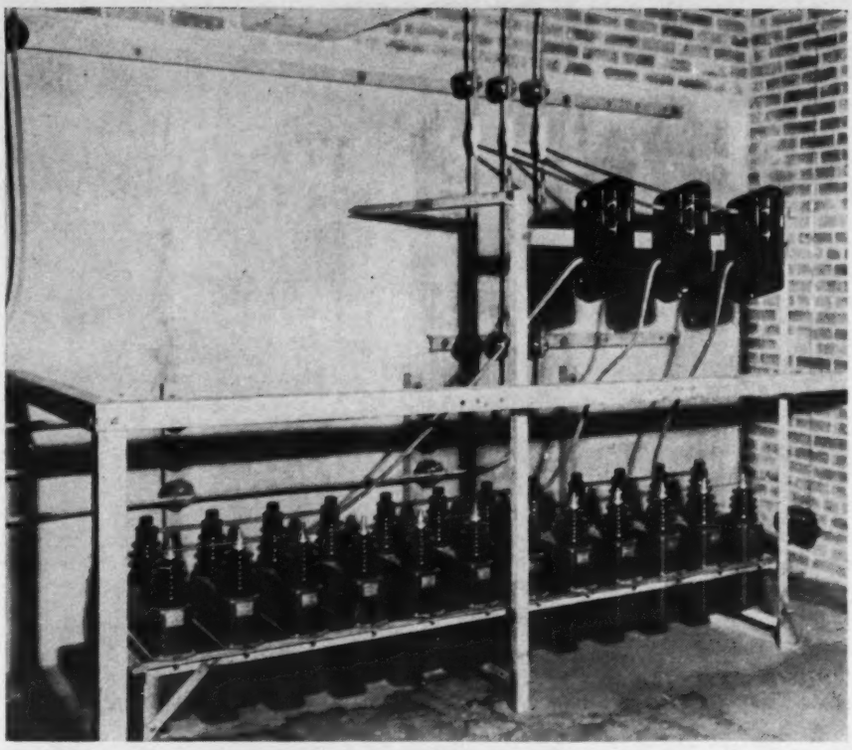


**FIG. 2—One of two pole-type, 180-kva., 2,300-volt capacitor installations in substation of utility; these are guarded by a structural steel frame made of second-hand angle bars with a 3/16-in. copper ground connection and plug switch for isolating the cans from earth when desirable**

### *Capacitors Help Transmission*

When a large block of power was purchased from Central Maine it was essential that it be taken at a good power factor; that is, that the amount of rkva. be relatively small. This was imperative if the voltage drop between the point of generation and that of utilization was to be kept within reasonable limits. If for any reason this load should have a lower power factor (*i.e.*, with a large amount of rkva.) not only would the voltage drop and power loss be correspondingly greater but the Central Maine Power system would then be subjected to the same inefficient use of its hydro-generating capacity as the Portland system. The losses from this inefficient use of water had to be made up by the use of fuel on a considerable scale.

The reason why it was impossible for Central Maine to carry additional rkva. was that at all major hydro plants the head has been increased by the addition of flashboards or excavation of the tailrace. This increased the kilowatt capacity of the water wheels for the same amount of water. In order to utilize this increased water wheel capacity it was necessary to operate the generators at a much higher power factor and therefore leave less reactive capacity. This increased capacity was very important under the conditions as it required no critical material and at the same time added to the company's load-carrying ability.

In general, hydro units are located in outlying territory and are connected with the system by relatively long transmission lines. If these stations supply the reactive, the transmission lines and transformer banks are loaded up with wattless current, involving a corresponding increase in voltage drop and power loss.

Prior to the load increase and the fuel shortage Portland extensively used the Cape station units to supply power-factor correction. This made it possible under good water conditions to obtain the additional power required by the system from hydro

**Table I—Improvement in Voltage and Power Factor by Capacitor Banks**

| Bank Number | Operating Voltage | Total Capacity Kva. | Steps Kva. | Voltage Readings | | | | Power Factor | | Load Kw. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Capacitors out | 1st Step in | 2d Step in | 3d Step in | Before Installation | After Installation | |
| 1 | 575 | 1,080 | 2-540 | 590 | 596 | 602 | ..... | 74.5 | 91.0 | 3,100 |
| 2 | 575 | 1,620 | 3-540 | 567 | 580 | 588 | 597 | 76.5 | 99.0 | 2,700 |
| 3 | 575 | 540 | 1-540 | 580 | 590 | ..... | ..... | 77.1 | 99.5 | 832 |
| 4 | 575 | 540 | 1-540 | 575 | 582 | ..... | ..... | 76.0 | 84.0 | 2,900 |
| 5 | 2,400 | 1,080 | 2-540 | 2,370 | 2,420 | 2,470 | ..... | 78.5 | 99.0 | 1,696 |
| 6 | 2,400 | 2,160 | 3-720 | 2,375 | 2,400 | 2,425 | 2,450 | 80.0 | 100.0 | 3,200 |

units on the Central Maine Power Co. system.

The need for synchronous capacity in the Portland district has been recognized for some years, but as long as the necessary rkva. could be absorbed by the Cape station and under the conditions then existing, the cost of a synchronous condenser was not considered justified. Conditions became very different with the onset of war. The system load reached the point in 1942 where at least 15,000 kva. of static or synchronous capacity was required at all times for satisfactory operation, and a total of 25,000 kva. of synchronous and static capacity could be economically used if available. Further increases in load than anticipated made more rkva. capacity essential.

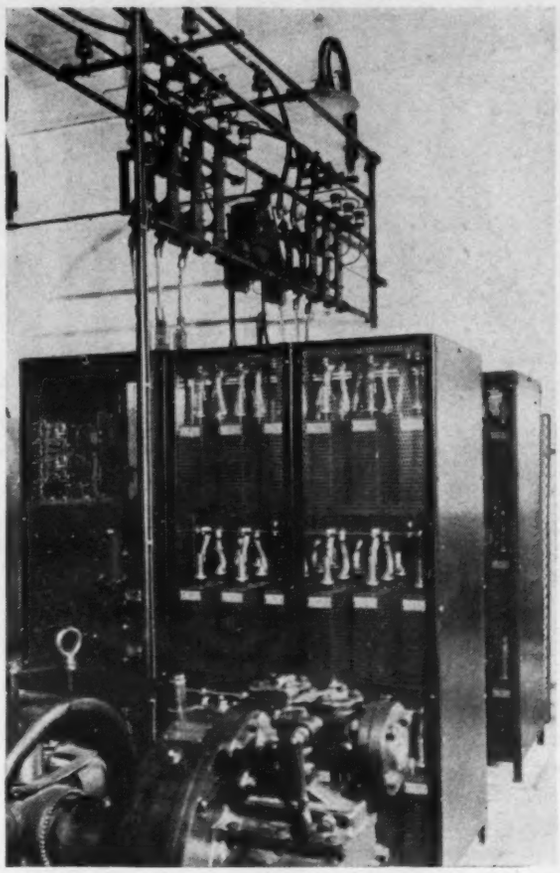


FIG. 3—Switched type of capacitor unit in industrial plant with automatic control by contact-making voltmeter

Mathematically it would be very difficult to determine the network voltage that would be obtained if the southern division were operated without some generating facilities being used as synchronous condensers, but experience showed that the voltage would be so low as to render the operation of motors impossible. For example, it was necessary to operate many plants not only on weekdays but on Sundays, when loads were relatively small, in order to maintain sufficient voltage on the bus at the South Portland shipyards so that they would not have trouble in starting large motors and operating welding equipment. Prior to the installation of capacitors it was at times difficult to start some of the large compressor motors in these plants.

Installation of the capacitors took care of a substantial waste of fuel oil and coal due to the operation of steam equipment for reactive kva. This was in accord with the intent of Limitations Order L94. However, there was a secondary saving in copper loss and voltage drop which was of major consequence. It was estimated that the saving due to decreasing the power loss under peak load conditions approximates 2,500 kw.

### *Fixed and Switched Capacitors*

Approximately one-half of the capacitors purchased were of the General Electric pole-top type and were permanently connected to the distribution system. The remainder, supplied by Westinghouse, was purchased in blocks to be automatically switched in one, two or three steps. These blocks were installed at the substations of larger industrial customers and the switching is controlled by contact-making voltmeters so that the capacitors come on and off with the load. The pole-type capacitors totaled 7,980 and the industrial 7,020 kva. Several of the pole type capacitors were installed in manholes in Portland without requiring special manhole design or reconstruction, and two other sets of the pole-type were installed at the Biddeford substation adjacent to the Cataract hydro plant. All the pole-type capacitors are built for 2,400-volt service. The industrial-type capacitors were divided between 575-volt and 2,400-volt units.

**Table II—Summary of Capacitor Switching Operations**

| Bank Number | Length of Period | Number of Operations | | |
|---|---|---|---|---|
| | | Step 1 | Step 2 | Step 3 |
| 1 | 5 Mo. | 436 | 447 | ... |
| 2 | 4½ Mo. | 353 | 407 | 345 |
| 3 | 4½ Mo. | 631 | ... | ... |
| 4 | 4 Mo. | 258 | ... | ... |
| 5 | 3½ Mo. | 214 | 124 | ... |
| 6 | 1 Mo. | 72 | 74 | 72 |

### *Results*

Table I lists the switched capacitor banks installed and the results of tests made where these were placed. From these tests it was found that the capacity of the bank was in general substantially higher than the nameplate rating, due, first, to the fact the capacitors are inherently built oversize and, second, that the final voltage was higher than the nameplate rating.

Table II summarizes the operations on each bank as shown by counter. Some of these were of course due to testing and adjusting.

The general result of the entire installation has been a substantial increase in voltage level throughout the transmission and distribution system of the southern division of Central Maine Power. This increase is from 5 to 7 percent above the original level. After the capacitor installation the power factor on the two 115-kv. transmission lines was much improved and their capacity increased approximately 25 percent.

The gain in kilowatt capacity can be considered from two angles: (1) it relieves 15,000 kva. of generating capacity formerly used to absorb rkva. and now made available for kilowatt generation; (2) it can be considered as purely thermal; in other words, the system capacity has been increased by about 7,200 kw. by the installation of 15,000 kva. in capacitors, with the same kva. load and the same heating limitations applying. Corresponding fuel savings result.

This article is based upon the conditions prior to and immediately following the capacitor installation, the benefits of which have been great under subsequent conditions on the system.

# Vectorscope Shows Phase Angles of E, I and Fluxes

***Electronic flasher aid to study, illuminates synchronously rotating disk stroboscopically to disclose relative vector positions of related 60-cycle voltages, currents and fluxes***

*LAWRENCE G. BETZ,* Public Service Electric & Gas Company, Hackensack, N. J.*

AN electronic-stroboscopic device called the Vectorscope has been devised to aid visually in verifying polyphase metering and relaying connections. It has also proved helpful as an educational aid in explaining distribution-circuit phasing and transformer connections to employees generally not familiar with vector theory.

Some of the specific uses to which it can be put are:

1. Determination of phase sequence, relative polarity, power-factor angle, phase of fluxes (simple, stray or combined), harmonics in stray or neutral currents and voltages.

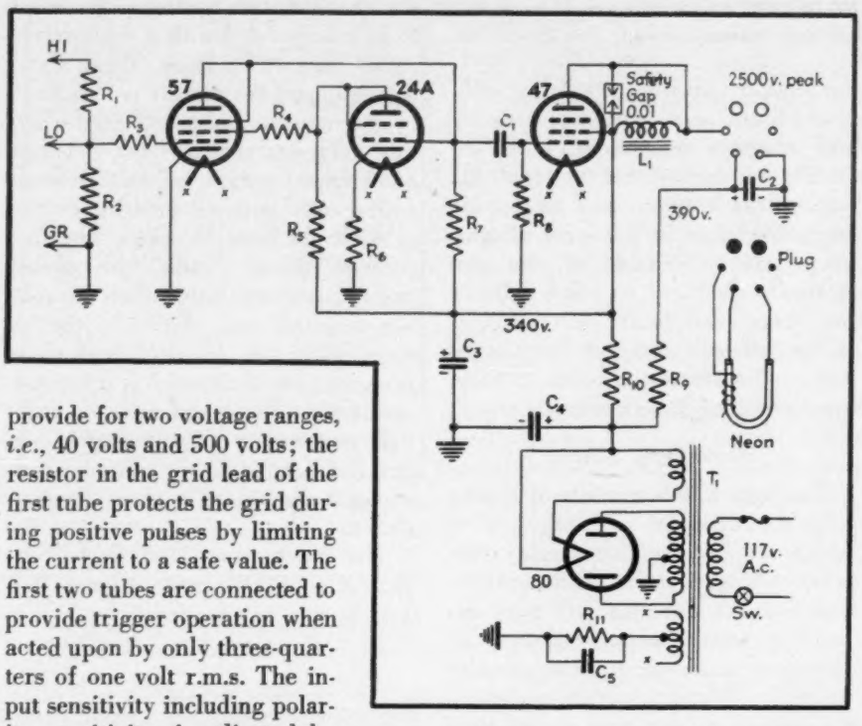
2. Verification of terminal arrangement and connections of reactive component transformers and phase-shifting transformers for volt-ampere and var measurements.

3. Demonstration of polyphase relations and the phase-angle results of additions or subtractions of voltages or currents.

### *Flasher and Disk*

Essentially the device consists of a disk, rotating at 3,600 r.p.m., upon which is impinged a light flashing sixty times per second for extremely short duration. The instant of flash is determined by the phase of the end of the negative half-cycle of the quantity being investigated. The recurrent flashing gives the illusion of stopping the disk, an arrow on which takes a fixed position. Various quantities tested in this manner will give approximate phase relations.

The input network is arranged to provide for two voltage ranges, *i.e.*, 40 volts and 500 volts; the resistor in the grid lead of the first tube protects the grid during positive pulses by limiting the current to a safe value. The first two tubes are connected to provide trigger operation when acted upon by only three-quarters of one volt r.m.s. The input sensitivity including polarity sensitivity, is adjusted by the rheostat R. The output of this circuit, as derived at the plate of the 57 tube, is nearly a perfect square-wave voltage swinging between —2 and —32 volts; when applied through the coupling condenser $C_1$ and the grid resistor $R_8$, the square-wave produces steep positive and negative pulses of approximately 20 volts amplitude on the grid of the 47 output tube.




**CIRCUIT for neon flashing of phase of voltages applied at HI (500 volts) or LO (40 volts) and GR (ground) terminals.**

Resistance elements have the following values:

| | Ohms | Watts | | Ohms | Watts |
|---|---|---|---|---|---|
| $R_1$ | 100,000 | 2 | $R_7$ | 1 Meg. | 2 |
| $R_2$ | 7,500 | 1 | $R_8$ | 1 Meg. | 1 |
| $R_3$ | 50,000 | 1 | $R_9$ | 2,000 | 10 |
| $R_4$ | 1 Meg. | 0.5 | $R_{10}$ | 1,500 | 5 |
| $R_5$ | 100,000 | 2 | $R_{11}$ | 600 | 2 |
| $R_6$ | 10,000 | Rheo. | | | |

Capacitor elements:

| | Microfarads | Volts | | Microfarads | Volts |
|---|---|---|---|---|---|
| $C_1$ | 0.002 | 400 | $C_4$ | 8 | 500 |
| $C_2$ | 2 | 500 | $C_5$ | 10 | 40 |
| $C_3$ | 8 | 450 | | | |

Inductance $L_1$ is 30 henries and 400 ohms
Power transformer $T_1$ is 325-0-325 volts r.m.s. and 35/35 milliamperes

### *Output Stage*

The output stage is a conventional audio-frequency output circuit with an inductance comprising the load. Chokes, output transformers, and even some interstage AF transformers, can be used as the output reactor,

*Assistant Division Meter Engineer, Bergen Division.

**NEON TUBE flasher and synchronous disk carrying "vector" arrow**

the special requirements being sufficient inductance, current capacity and adequate insulation. It is advisable to connect the plate to the outer turns terminal and to provide extra insulation in the form of strip mica between outside of coil and core. On the steep negative pulse to this stage most of the plate current is cut off and the resultant surge across the reactor reaches a value approximating 2,500 volts.

### *Neon Light Source*

The light source consists of a neon tube the diameter and pressure of which are standard for display purposes. The distance between electrodes is 12 in.; this will vary depending on the supply voltage, 25 volts per inch being approximately optimum. Magnet wire is coiled on the outside of the tube to act as a capacitive firing electrode. This tube can be made to order by local sign makers at a cost usually below two dollars. Care should be taken to avoid the use of fluorescent type tubing.

Of importance in the circuit is the gap shown connected in shunt with the output reactor; set at approximately 0.010 in., it protects the tube elements, socket, wiring and reactor insulation from flashover. The gap may be constructed by drilling and tapping a small piece of plastic material for No. 10-32 screws; these should be pointed, inserted to provide the proper gap and locked with nuts.

Optimum value of discharge condenser, $C_4$, is 2.0 mfd. This condenser and resistor $R_8$, must have an $RC$ value that will provide for adequate charging between firing pulses; if a more intense flash is required, the condenser may be doubled and $R_6$ halved. This will of course increase transformer loading and affect the level of direct-current voltage.

### *Adjustment*

Adjustment of the circuit must not be attempted until at least one minute has elapsed to permit tubes to warm up. Rheostat $R_6$ is first reduced to almost zero; it is then slowly increased until a flash occurs in the neon tube. Because only the initial adjustment is necessary, unless tubes are changed, this control is arranged to be manipulated with a screwdriver rather than with a knob. When set in this manner, the circuit is "cocked" by the negative pulse and fired when this voltage returns to zero. This can be checked by applying voltage from a dry cell; positive polarity to the grid should have no effect, negative polarity should "cock" the circuit and firing should occur when the voltage is withdrawn. Acting at the instant when the negative half cycle becomes zero, the circuit is independent of wave shape and voltage amplitude over a very great range; herein lies the feature of the device which makes it adaptable for phase determination.

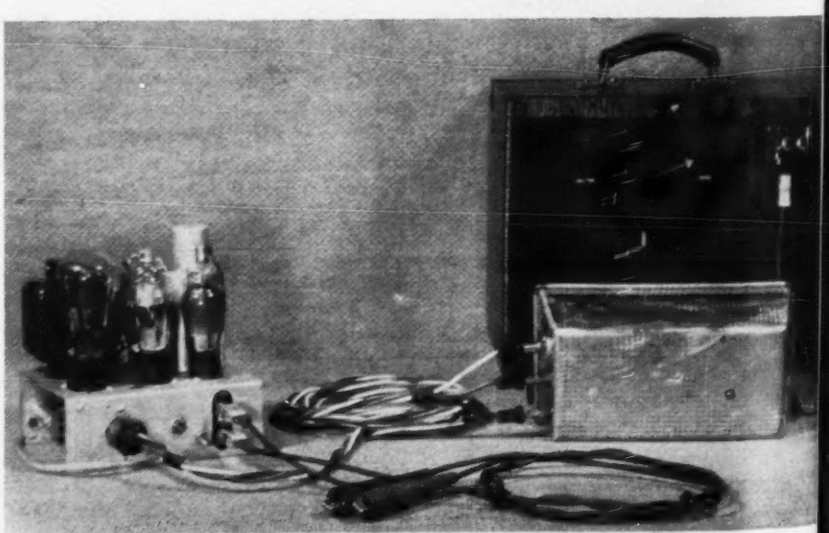
The synchronous disk drive consists of an 1,800-r.p.m. motor geared 1 to 2; this may be necessary as it is difficult to obtain small synchronous motors built to operate at 3,600 r.p.m. The motor shown has a two-phase winding, the quadrature voltage being provided by means of a series capacitor; at the time of starting, additional capacity is momentarily added manually in order to bring the disk into synchronism. The motor mounting is concentric with the disk shaft and held in position by friction; by means of a key, the disk can be positioned radially for the reference quantity.

The spark-gap and the neon tube are shown in the foreground in the accompanying illustration.

The complete device arranged for classroom use is pictured in the illustration below; the carrying case serves as a hood for the disk, thereby permitting operation in a normally lighted room.

### *Application*

For the application of currents, shunts must be used which will provide approximately 2 volts. Magnetic fields may be explored by means of air-core coils of physical dimensions appropriate to the problem, but it must be remembered that the vector so derived will lag 90 deg. from the actual flux; this can be almost entirely corrected by inserting an 0.01-mfd. condenser in series with the search coil providing that the field is strong or that the search coil can be given sufficient number of turns to produce at least 35 volts. Where the values to be measured are small, it is advisable to precede the circuit shown with a stage of voltage amplification.



**CARRYING CASE serves as a hood, permitting use of the Vectorscope in a normally lighted room**

# Good Weld Voltage Demands Low Supply Impedance

*Six alternative methods considered in decision to bring high-voltage, low-impedance circuits as close as feasible to the welding load*

*C. N. CLARK, Distribution Section Engineer, Planning Division, Duquesne Light Co., Pittsburgh, Pa.*

VOLTAGE at the primary terminals of a resistance welder must be held within reasonable limits in order to produce satisfactory and consistent welds. Since the supply voltage at no load seldom exceeds the rated voltage of the welder by any large percentage, few welding troubles are traceable to high voltage.

Drawing of large single-phase loads from a supply system of relatively high impedance, however, does occasionally so reduce the voltage that unsatisfactory welds are obtained. Improvement of voltage to satisfactory levels in these cases often necessitates expensive changes in the power supply systems. This should be avoided wherever possible in order to prevent the premature retirement of part or all of the facilities installed for the original welder service.

### *Methods Considered*

In connection with a recent welder installation an investigation was made of six methods of supplying 440-volt, single-phase power service to a 200-kva. spot welder. These methods consisted of variations and combinations of supply from extensions of the nearest 2.3-kv. and 22-kv. circuits.

Due to the excessive voltage fluctuations involved, no other customers could be supplied from the 2.3-kv. circuit between the 22/2.3-kv. transformer station and the welder. The distance from the distribution substation to the customer's plant was approximately 1 mile and from the nearest 22-kv. line to the customer's plant was slightly over ½ mile.

A brief description of the six methods follows (see Fig. 1):

I. 2.3-kv., single-phase, exclusive circuit from distribution substation using one 75-kva., 2,300/460-volt transformer at the customer's plant.

II. Similar to I, using one 150-kva., 2,300/460-volt transformer.

III. Similar to I, using one 200-kva., 2,300/460-volt transformer.

IV. One 200-kva., 22,000/2,300-volt transformer at the 22-kv. line, exclusive 2.3-kv. circuit to the customer's plant and one 200-kva., 2,300/460-volt transformer at the plant.

V. Extension of 22-kv. circuit to the customer's plant and using one 100-kva., 22,000/460-volt transformer at the plant.

VI. Similar to V, using one 200-kva., 22,000/460-volt transformer at the customer's plant.

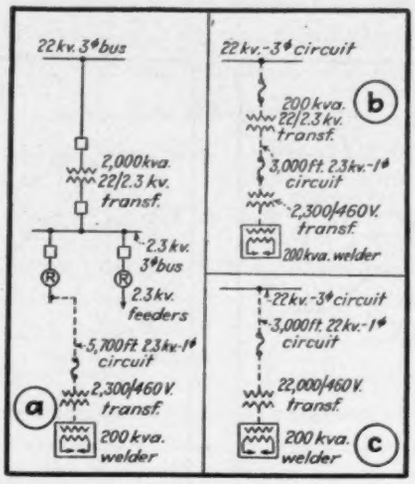



**FIG. 1—Welder of 200 kva. could be served from a 22-kv. source by any of these six methods:**

**(a) 2.3-kv. circuit extension from distribution substation.**

**Method I—74-kva. transformer at welder.**

**Method II—150-kva. transformer at welder.**

**Method III—200-kva. transformer at welder.**

**(b) 2.3-kv. circuit extension from new transformer station at 22-kv. line.**

**Method IV—200-kva. transformer at welder.**

**(c) 22-kv. circuit extension to welding load.**

**Method V—100-kva. transformer at welder.**

**Method VI—200-kva. transformer at welder.**

### *Welding Voltages Compared*

Calculated voltages at the 440-volt terminals of the welder for the six methods, based upon an estimated welder duty of 240 kva. in all cases, also the corresponding welder currents, appear in Fig. 2. The voltages and currents are plotted against total impedance from the generating station to the welder in 440-volt terms to show the effect of changes in system impedance; 475 volts was assumed at the welder under no-load conditions.

Under Method I the welder requires 985 amp. at 244 volts. This represents a drop of 49 percent from the no-load voltage and is 44 percent below the rated nameplate voltage.

As the power system impedance is decreased the current decreases and the voltage increases for the assumed constant load of 240 kva. For Method VI the welder requires only 555 amp. at 433 volts. This is a drop of 9 percent from the no-load voltage and is less than 2 percent below the rated nameplate voltage.

Of the six methods shown, only Methods V and VI would provide voltages above 90 percent of nameplate rating for the proposed 200-kva. welder with a duty of 240 kva. A 22-kv. line extension would be required, also the installation of 22,000/460-volt transformers of 100 kva. and 200 kva. respectively near the welder under these two methods.

Calculated maximum kva. which could be drawn by the welder and the corresponding voltages at the welder

for the six methods appear in Fig. 3. These values are plotted against the supply system impedance to show the effect of changes in system impedance.

As a coincidence, it will be noted that the required duty of 240 kva. assumed in Fig. 2 is just equal to the maximum duty which could be drawn by the welder as shown under Method I in Fig. 3.

With the higher voltages available in Methods V and VI, due to lower system impedance, the maximum welder duties would be increased to 407 kva. and 540 kva. respectively. With still lower system impedance the maximum duty at the nameplate rating of 440 volts is 783 kva., which corresponds to the maximum duty furnished by the welder manufacturer.

### *Simplified Approach*

A resistance welder may be considered as a load of variable impedance which can be adjusted, within the limitations of the equipment design, to draw a required kva. from the line for a rather wide range of voltage conditions which might be encountered under available methods of supply.

The kva. duty, power factor and minimum operating voltage for the proposed welder should be obtained from the customer or manufacturer. In some instances these data are not available and must be estimated by power company engineers, based upon experience with other similar welding operations.

Welder current at the minimum operating voltage can be obtained by dividing the kva. duty by this voltage. Allowable voltage drop in the power system is the difference between the voltage available at the welder for zero welder load and the minimum operating voltage.

Dividing the allowable voltage drop by the above welder current gives an equivalent impedance for a theoretical power supply which would deliver the desired kva. to the welder at the minimum operating voltage.

This equivalent impedance is merely the volts drop per ampere at the assumed power factor for the theoretical power supply, based upon a variation of a well-known approximate formula for voltage regulation.

$$Z_{EQ} = \frac{E_1 - E_2}{I} R \cos \theta + X \sin \theta.$$

$Z_{EQ}$ = the equivalent impedance.
$E_1$ = the voltage at the source.
$E_2$ = the voltage at the load.
$I$ = current in amperes.
$R$ = resistance of the power system.
$X$ = reactance of the power system.
$\theta$ = angle whose cosine equals the power factor.

By the use of tables of equivalent impedances (volts drop per ampere at selected factors) for the various components of the power system it is a simple matter to determine the equivalent impedance for each method of supply being considered. All values of equivalent impedances should be expressed in the same voltage terms and those based on the same power factor may be added arithmetically.

### *Choosing the Supply*

Calculate the maximum allowable equivalent impedance for the required welder duty and eliminate those methods which have equivalent impedances in excess of this value. The choice from the remaining methods will depend upon the voltage, cost and critical materials required.

Manufacturers usually recommend that the minimum voltage at the welder be equal to 85 to 90 percent of nameplate rating in order to obtain satisfactory operation. It is frequently necessary to extend high-voltage, low-impedance circuits to locations adjacent to the welding loads in order to provide adequate voltage for satisfactory operations.

Two good rules to follow in selecting a power supply for resistance welders, as well as other loads, are:

1. Know the characteristics of the load.

2. Know the impedances of the power system.

Other electrical equipment is not expected to operate at 50 or 60 percent of nameplate voltage, so why try to do it with welders? The voltage at the welder depends upon the impedance of the power system. Adequate welding voltage means limiting the system impedance to reasonable values.

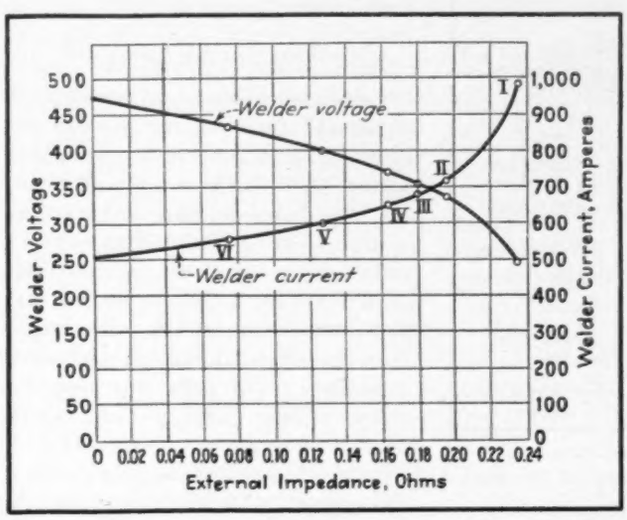



**FIG. 2—The less the equivalent system impedance the higher the welder voltage and the less the welder current; six methods of supply indicated. Assumptions: estimated welder duty, 240 kva.; no load voltage at welder, 475.**

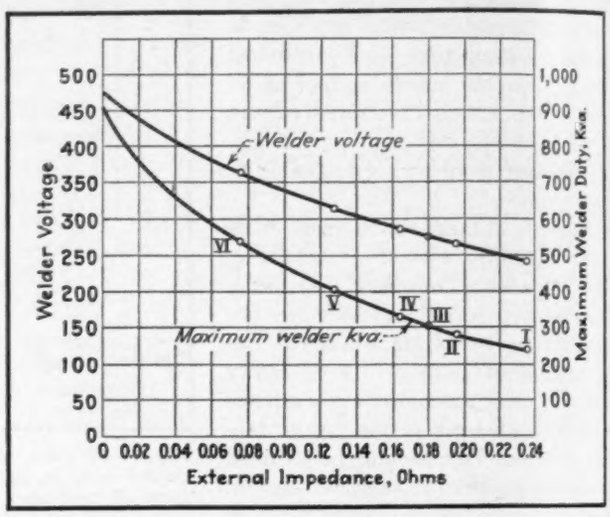



**FIG. 3—Effect of equivalent system impedance on maximum duty and voltage of 200-kva., 440-volt welder adjusted for minimum welder impedance.**

**Same six schemes for supply indicated**

# Removes Silica Scale From Cooling Coils

*Three-operation cycle of hot chemical circulation, air drying and acid circulation employed for transformer cooling coils and boiler tubes—Method for mitigating scale problem*

F. B. VILLER,* *Pacific Gas & Electric Co., Fresno, Calif.*

SECTION of transformer cooling coil showing extent of silica scale being successfully removed

REMOVAL OF SCALE from the water cooling coils of transformers has been a problem for many years. Numerous methods have been tried with varying degrees of success. Water conditions generally on the P. G. & E. system are such that uninhibited hydrochloric acid alone has proved cheap and quite satisfactory. In the San Joaquin power division, however, where the scale formed contains a high percentage of silica, hydrochloric acid has not proved effective.

Many years of effort, including submission of samples to various laboratories and chemical companies, failed to bring an answer. The author set about the problem and has developed a three-operation, caustic-metaphosphate, air and hydrochloric acid cycle that has proved effective.

*Maintenance Engineer, San Joaquin Division.

### *First Operation*

A solution made from flaked chemicals consisting of 4.8 oz. of caustic chemical and 3.5 oz. of metaphosphate per gallon of water is heated to a temperature of 88 deg. C. and circulated through the coils for about 24 hours. Electric immersion heaters are used to supply the required heat.

Each 8-hour shift it is necessary to add make-up solution consisting of 4 lb. of caustic and 6 lb. metaphosphate. Water added is logged to prevent dilution or over-concentration of the solution.

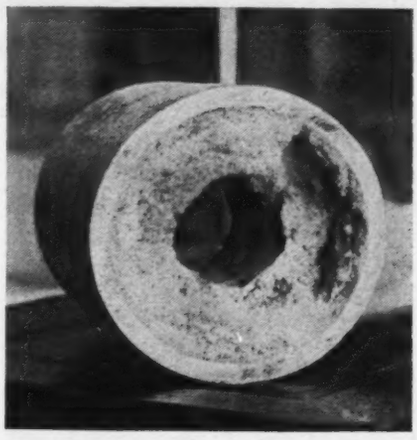
After completing the 24-hour operation air is blown through the coils to dry them thoroughly. This takes 15 to 20 minutes. The transformer is then allowed to cool down to a temperature of 50 deg. C. and is ready for the next operation.

### *Second Operation*

The coils are again dried with air for a period of five minutes. This causes the scale material to contract from its expanded condition produced by the circulation of the hot caustic solution. Expansion and contraction of the exposed outer layer of scale will cause small fissures in the remaining walls so that application of an acid will penetrate down into the scale.

### *Third Operation*

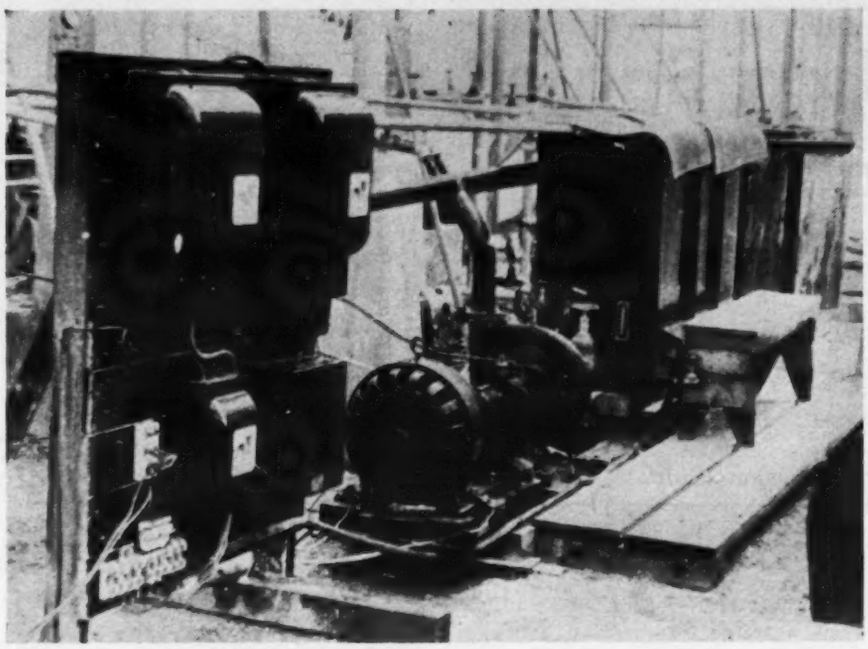
The inside of the coils having again been dried with air, a second solution is pumped through them. This consists of one part hydrochloric acid, 35 percent strength, three parts water and 1 oz. of powdered hibbitite for each gallon of mix. Twenty gallons of this solution is placed in a special acid handling tank with sloping baffle to enable drawing away of the accumulated foam which will come from the coils.



SILICA SCALE in boiler tubes also is being removed by caustic-metaphosphate, air and hydrochloric acid cycle.

Foaming will continue as long as there are openings in the scale. Decrease in foaming indicates that there are no longer fissures in the scale into which acid can penetrate and work. The coils are again blown out with air. The complete cycle of hot chemical circulation, air drying and acid circulation is then repeated as many times as may be necessary to remove all scale. Flow tests in gallons per minute can be made after each operation to show progress of the cleaning.

After the final cleaning with acid the coils are again blown out with air and again placed on caustic circulation for about four hours. The coils,



**TEMPORARY EQUIPMENT** set-up for circulating hot solutions in removing cooling coil scale.

then being thoroughly cleaned, are blown out with air and flushed with clean water.

In some cases it may be necessary to change the operating temperature of the hot solution or change the concentration of the acid mixture to obtain successful results. Placing the acid mixture in the coils before a caustic or air drying operation has little or no effect in breaking up the scale.

### *Three Stages Essential*

Successful operation requires three things: First, hot caustic circulation; second, complete drying with air and, third, the acid mixture for direct action into the fissures of the scale. Care must be taken in handling the caustic and acid solutions to prevent accidents. Goggles, rubber gloves and rubber apron should be worn.

While this process for scale removal may sound involved and requires considerable time, nevertheless it is the only solution to the silica scale removal problem that has been found. Use of this method has saved replacement at considerable expense of transformer water cooling coils. Moreover, application to the removal of scale in boiler tubes has proved successful.

### *Mitigating Scale Problem*

Naturally, attention has been given to prevention of scale formation by looking to the water used. The scale problem is aggravated by the fact that the silica content of the water continually increases as a result of constant recirculation through a cooling tower. The only practicable means suggested of mitigating the scale problem is the use of two wells instead of a cooling tower, drawing water from one and pumping into the other.

The wells must be far enough apart so that the water does not circulate too rapidly between the wells and build up in temperature. Fifty feet is usually sufficient spacing. The well from which the water is pumped should be deeper than the discharge well to aid in recovering as much of the water as possible.

Although this practice is well worth while where it is practicable to use two wells and is actually being used with good success to mitigate the scale problem on several installations, nevertheless it is no solution to the real problem of removing the scale once it has formed.

The author's idea for scale removal received second award in the 1942 employees' suggestion contest of Pacific Gas & Electric Company's research committee, under the chairmanship of W. G. Vincent, vice-president and executive engineer.

• • •

## What to Use for Exhauster Fan Blades

In an attempt to determine the least expensive and most durable material for pulverized-coal exhauster fan blades careful operating records have been kept of the life of various blade materials used at steam plants on the Oklahoma Gas & Electric system.

The accompanying tabulation indicates the hours life and coal tonnage passed by exhauster fans blades made of (1) smooth boiler plate, (2) boiler plate with beads of wear-resisting weld-metal applied to the surface, (3) boiler plate blades with a solid coating of wear-resisting metal and (4) checker floor plate:

| Blade Material | Hours | Tons Coal |
|---|---|---|
| First set smooth boiler plate..... | 904 | 4,128 |
| Second set smooth boiler plate..... | 904 | 3,745 |
| Boiler plate and welded beads.... | 1,808 | 7,875 |
| Boiler plate solid wear coating.... | 1,808 | 7,873 |
| Checkered floor plate..... | 1,750 | 6,890 |

When cost is considered, conventional diamond checkered floor plate was found from these records to give the best combination of cost and life. In recent months however, floor plate has become a scarce item and it has been necessary to fall back on the next best material, steel boiler plate with several beads welded across the face of the blade parallel with the shaft, in the area of the blade near the tip where wear is most severe.

By experimentation, it was found that acetylene welding rod for cast iron applied by metallic arc welding in beads on ¾-in. centers gave the best wear characteristics. To impart extra hardness to the beads blades were quenched in water as each bead is applied.

Cost analysis reveals that application of the beads to the boiler plate blades doubles the life at a total cost of $0.75 per blade for applying the weld metal. Stated another way, it was found that for 1,800 hours of life a total saving of $27.15 per exhauster fan can be realized by using beaded boiler plate instead of smooth blades. However, blades prepared in this manner are at best a substitute for diamond checkered floor plate, which was still the most economical material. (Where diamond floor plate was used blades were cut to have the rows of raised beads parallel with the exhauster fan shaft.)

# Network Assures Service Reliability in Aircraft Plant

***Boeing's Renton Division incorporates features of electrical distribution that make for continuity of supply, facility of maintenance and ease of control***

**GLEN WALKER**, *Plant Engineer, Renton Division, Boeing Aircraft Company, Seattle, Wash.*

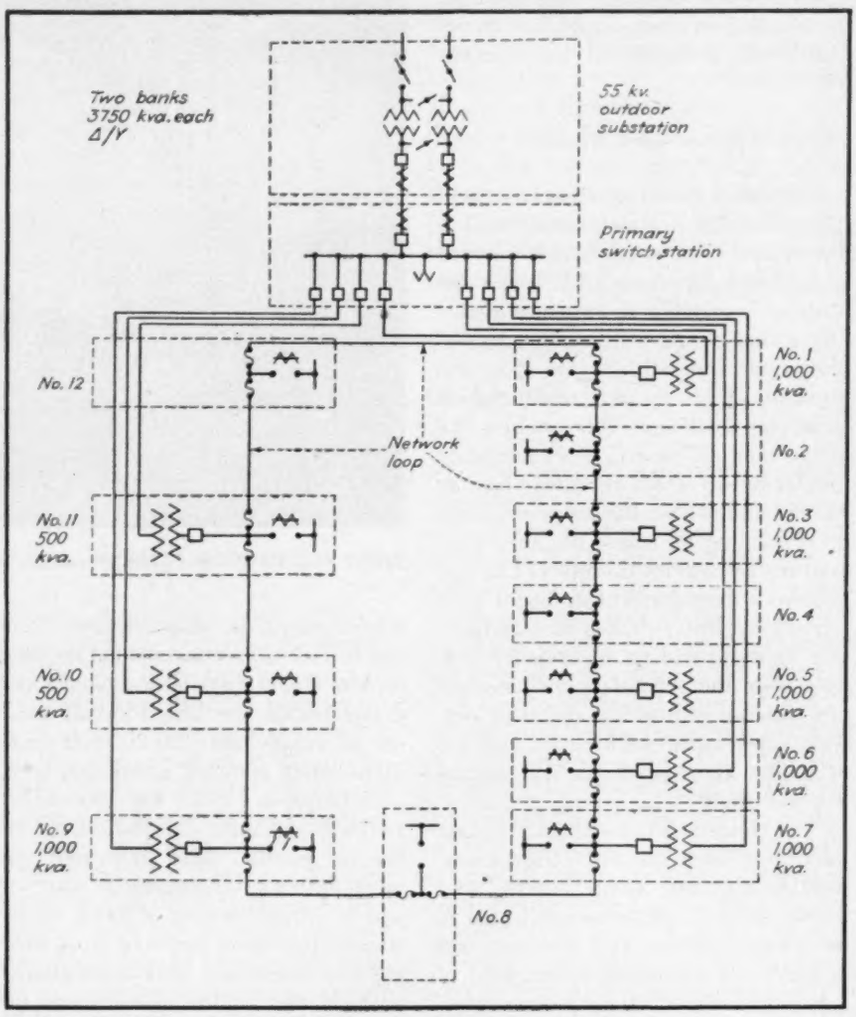
WHEN, a short time ago, the Boeing Aircraft Co. contemplated a duplication of manufacturing facilities at Renton, about 20 miles from the Seattle plant, the electrical engineers of the company had an excellent opportunity to put into practice some of their plans developed from experience at the older plant. The thinking was to keep the system simple, integrated, amply able to fulfill present requirements, and sufficiently flexible to care for future developments.

The Renton division of Boeing was deliberately located on a site approximately one-half mile from two sources of electrical power. In one direction is a power station, from which a 55-kv. line feeds the plant substation. In another direction, about the same distance away, is a switching station of the same power company. From this source comes a second 55-kv. line. Because of the close proximity to these sources of power where lightning arresters were provided, it was considered by the engineers unnecessary to install such protection in the Boeing substation.

The outdoor substation contains two banks of transformers each of three 1,250-kva., OISC, 55 kv., 2,560,-volt transformers connected delta-wye to provide 4,430-volt, three-phase service for primary distribution within the plant. Arranged for forced cooling, the capacity of these transformers can be increased, when necessary, to 1,600 kva. each to take care of future load increase.

Two 4,500-volt underground feeders lead the power through metal-clad outdoor switch houses in the outdoor substation to the primary switching cubicle in the central control room. Each switch house contains a Magne-Blast air circuit breaker with over-current, current-directional and differential relays. The differential relays are for the protection of the underground cables.

The control and distribution of




**NETWORK SERVES** twelve load centers from eight transformer banks

power within the plant is centralized in a 4,500-volt, metal-clad switching cubicle located in a central control room. This cubicle consists of twelve sections and is symmetrical from the center toward each end. A three-phase, three-wire, 4,500-volt continuous bus runs the entire length of the cubicle. The four center sections contain Magne-Blast air circuit breakers, directional over-current and differential relays and associated control devices and instruments. The four outer sections on each end of the cubicle contain the same kind of breakers, over-current relays and equipment for controlling and indicating the primary feeders to the network transformers located throughout the plant.

The incoming cables and the outgoing feeder cables are three-conductor varnished cambric, lead covered, terminated in compound-filled three-conductor potheads of the conventional type.

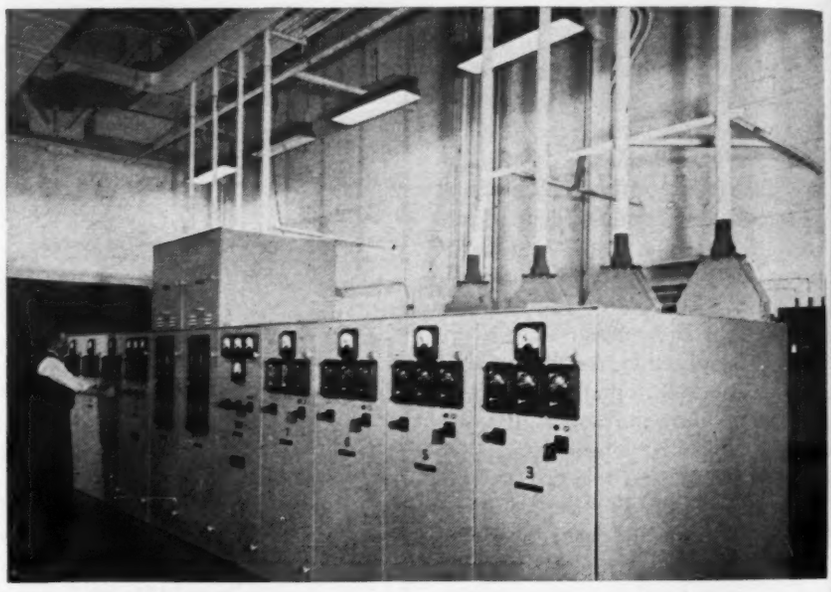
### *Dispatcher's Board*

Separated from the primary switching cubicle by a glass paneled wall is the central control dispatcher's board containing apparatus with which the utilities dispatcher can see at a glance the status of all utilities throughout the plant. Indicating lights show the position of all primary and network protector switches. This enables the dispatcher to ascertain immediately the feeder on which an outage has occurred and to take the necessary steps to determine the cause of the outage and restore service promptly. The dispatcher's board contains pistol grip remote-control switches and indicating lights providing supervisory control over the secondary switches on the outdoor substation and over outside yard, fence, parking lot and obstruction lighting from the central control room.

The connected power load for plant facilities, such as air compressors, ventilating fans, sump pumps, unit heater motors, etc., was calculated to be about 2,000-hp. and provision was made for a connected power load of approximately 6,000 hp. for manufacturing machinery and processes distributed throughout the plant. Because of the wide distribution of both the lighting and power loads, it was found necessary to keep the voltage drop in power and lighting feeders within limits of good engineering practice. This was done by establishing twelve load centers throughout the plant. G.E. natural-draft, three-phase, 4,430-254/440-volt transformers are installed at eight of the twelve load centers. Six of the transformers are rated 1,000 kva. and the other two at 500 kva. Each load center contains a metal-clad cubicle-type distribution panel which contains a main 2,000-amp., 600-volt, three-pole air circuit breaker connecting the panel bus to the 440-volt transformer secondary. The panels also contain Deion breakers of from 50- to 600-amp. capacity connecting the branch feeders to the panel bus. Banks of three Westinghouse dry type 254/120-volt auto-transformers, in sizes varying from one to 75 kva., are installed at the load centers and at distribution panels and connected to the 254/440-volt feeders to supply the 120-208-volt local distribution systems, mentioned later.

Experience with the secondary radial load center distribution at the Boeing Seattle plant indicated the most desirable arrangement was one which would permit a load center transformer to be removed from service for inspection and maintenance without interruption of service on the feeders radiating from the load center. To provide this feature the load centers were connected together in a four-wire, 254-440-volt network loop of two or more conductors in parallel in each phase and neutral. Each section of the network loop is connected to the load center bus through Burndy limiter lugs. The load center transformers are connected to the load center bus through automatic network protectors. Primary distribution to each load center transformer is through a 4,430-volt, three-conductor, varnished cambric, lead covered radial feeder in iron conduit from the primary switch cubicle in the central control room. The primary feeders are connected directly to the load center transformers through 5,000-volt oil disconnecting cutouts.

Relays on the load center transformer secondary network protectors are set so the transformer will be automatically connected to the network loop when the transformer is energized from the primary side and to disconnect the transformer from the network on a slight reversal of power through the transformer. This arrangement enables a load center transformer to be placed in service or removed from service merely by closing or opening the primary breaker on its feeder in the central control room.



**EIGHT DISTRIBUTION FEEDERS radiate from this single-bus switching station**

A high standard of lighting conditions in the factory areas was planned. Minimum lighting intensities at working heights are:

Storage areas, 15 foot-candles.
Shop areas, 25 foot-candles.
General offices, 40 foot-candles.
Drafting office areas, 50 foot-candles.

In about one-third of the factory area structural and manufacturing clearances make mounting heights of

lighting fixtures 45 ft. above the floor necessary. In the remaining two-thirds of the factory areas clearances permit fixture mounting heights of 25 ft. above the floor. In order to obtain the desired lighting intensity over the relatively large high bay final assembly area (this area being greater than a dozen football fields), the most efficient light sources available were investigated. High-intensity mercury-vapor units were found to be most suitable for high bay mounting. However, this type of unit requires a long period of heating up before producing full light output on starting and casts an unnatural blue-green light. To take advantage of the good characteristics of the high-intensity mercury-vapor light and at the same time have a quick starting light and one that would blend with the mercury vapor light and soften it, the decision was made to install alternate high-intensity mercury-vapor units and 3,500-deg. white fluorescent units in the high bay areas. A 400-watt mercury-vapor light source, installed in a deep bowl reflector, having a lumen output of 16,000, was found to be about equal to two RLM fluorescent reflectors installed in tandem, each containing two 400-watt fluorescent lamps. These alternate mercury-vapor and fluorescent units were installed on 15-ft. centers throughout the final assembly area to give a minimum lighting intensity of 25 foot-candles on the floor 45 ft. below.

For the low bay lighting, in almost two-thirds of the areas, RLM fixtures, each containing three 40-watt fluorescent tubes, were selected, spaced on 12½-ft. centers on the short axis and 10-ft. centers on the long axis of the reflectors to give a minimum lighting intensity of 25 foot-candles at working heights.

Outside yard areas are lighted with conventional floodlighting reflectors, with 1,000-watt, 260-volt lamps, mounted on the roofs of the plant buildings. The property line fences are lighted for protection purposes with narrow beam luminaires hung from mast arms mounted on wood poles and operated from a 6.6-amp. series lighting circuit. The employees' parking lots are lighted with Fresnel 180 deg. lens luminaires mounted on wood poles bordering the lots and operated from a similar series circuit. Toilet rooms, corridors, exits and vestibules are lighted with 120-volt incandescent lamps. The total lighting load of the plant is about 3,000 kw.

The circuits to the many lighting fixtures (approximately 16,000) to be installed over the extensive factory areas would have to be relatively long, which made it desirable to supply these fixtures at a higher voltage than the usual 120-volt supply to keep the voltage drop within recognized limits without excessive use of copper conductor. By installing a single 254/440-volt, four-wire system, the lighting circuits would be served at 254 volts and the power circuits at 440 volts.

In a plant the size of this there are a large number of portable machines and tools and office machines powered with fractional-horsepower motors used throughout the plant and offices. Also a large number of portable lights are used in and around the airframes in the process of assembly, as well as local lights on many machine tools. Standard equipment of this character requires 120-volt, single-phase power supply. To provide service to this type of equipment a 120/208-volt, four-wire supplementary power distribution system was laid out. Circuits and receptacles connected to this system were run in floor trenches in the main assembly areas and four-wire mains were run in a bus-gutter on the ceiling over the fabrication areas and under the floor of the sub-assembly areas. Branch circuits were run from this bus-gutter to drops with fuses and plug receptacles, as required over machines and benches below and to fused receptacle stands, adjacent to machines and benches on the sub-assembly floor above, through conduit sleeves installed in the concrete floor slab.

**ALL ELECTRIC SYSTEM OPERATIONS are controlled and supervised from this central point**

## Electric Service in Europe

According to the German radio, as reported by the *Electrical Review* (London, England) electric service to the citizens of the Reich is hardly worthy to be so called. Further restrictions on the use of electricity in hotels and boarding houses and for operation of elevators were imposed last December. The load in the Dusseldorf area is so heavy between blackout time in the early evening to 10 p.m. that on several occasions the supply has broken down. Customers have been warned not to use electric heating devices during that period except in cases of illness. In Breslau electric space heating has been entirely forbidden.

In Sofia, Bulgaria, the public has been informed that unless there is a substantial reduction in electricity use the domestic supply will have to be cut off. Users are reminded that all forms of electric heating are forbidden and warned that no equipment other than lights may be used from sundown to 8 a.m.

# Editorials

S. B. WILLIAMS, *Editor*

## *Credit for Power Adequacy*

IT WAS NOT so very long ago that Chairman Leland Olds of the Federal Power Commission virtually washed his hands of the national power supply because it was so totally inadequate. Now he beams with pride at the industry's accomplishments and without restraint takes the credit. At the recent hearing of the House subcommittee on appropriations for independent offices he said: "I think the commission's work, beginning particularly in 1938 and coming down to the period when WPB had built up very considerable staffs at the end of 1941 and 1942, was the real explanation of the adequacy of power supply for the war effort."

Mr. Olds is going to find it as hard to be convincing in this case as the chap who claimed to be the father of a ravishing blonde whom he had disclaimed at an earlier age.

There will probably be lots of other people who will claim credit for the war adequacy of power supply because it is probably the outstanding example of preparedness in the entire business fabric of America. In most instances they probably had a finger in the pie, but when all credit is given fairly the fact that will stand out in bold contrast is that the power industry itself is more responsible than any other single thing. It has been a practice of the industry always to make provisions for expanded usage well in advance, with the result that it has always had a substantial capacity reserve just to take care of new load.

Next to the industry itself, if we were giving out prizes for the part played in having power adequacy, would come the power branch of WPB and its successor, the Office of War Utilities. Large credit must go to this agency because, as is shown elsewhere in this issue, it regulated the war utility program with understanding based upon fact and analysis.

Somewhere high in the honor list would come the people who toiled to keep the equipment running, sometimes with about as much improvising to do as the ancient Jews who had to make bricks without straw. A big credit was given them a few days ago by J. A. Krug, director of OWU, who in complimenting employees of the Hartford Electric Light Company with long service records, said: "The employees of the electric industry are deserving of the highest praise and recognition for the great part which they have had in making this remarkable performance possible."

Also credit is due to the manufacturers who overcame tremendous obstacles to get the equipment out to the customers.

In other words, this was a job of teamwork by people who had but one goal—winning the war. Anyone who claims the full credit is presumptuous, and particularly one who was so unpleasantly critical of the program in its making.

## *OPA Denied Rate Jurisdiction in States Having Regulation*

LITTLE ATTENTION was paid at the time to the January 31 Supreme Court decision in the Davies Warehouse case because its significance was not appreciated. A study of the opinion, however, discloses that the court has denied to OPA any authority over utility rates that are determined under state regulation. It was another reaffirmation of the principle that rates or prices already under public control do not need additional regulation.

The law is clear on this point, but OPA had taken the position that it was in a better position to judge the effect of utility rates upon the economy of the country than the commissions that had been regulating them for years. In fact, the OPA was so presumptuous as to claim authority to determine the constitutional status of state regulations with respect to particular industries.

It has always been difficult to understand why OPA should be so interested in utility rates when their very stability was the thing desired by the act which set up that agency. The only reason one can surmise is that pressure was brought by the anti-utility group, of which the spearhead in Congress at the time the act was amended was the late Senator Norris.

This decision ought to remove OPA completely from the field of utility rates in states having jurisdiction, but what of the few that do not exercise control over rates? The thought is that OPA might step in there, if for no other reason than to save face.

There is nothing in the act that can be construed as a directive in this matter, but this most recent decision in a back-handed way seems to indicate that without state regulation OPA control would be a horse of a different color.

However, the absence of state regulation does not necessarily imply no local control. In Texas, for instance, the control is with the municipalities. Frequently local control is more drastic than state regulation. Are these places to be denied their local autonomy just because they, instead of the state, regulate utility rates?

If utility rates were increasing there might be some justification for this interference, but they aren't. About the only rates that have advanced are those in which an automatic fuel clause is made a part of the contract. For the most part these contracts are for large usages at rates so low as to be quickly affected by changes in fuel cost. If this is inflationary, the place to correct it is not with the utilities, but with those who cause higher fuel prices.

By thus removing OPA from utility rate control the public is losing no control and the prestige of state regulation is further increased.

## Let Both Sides Be Told

THE SENATE agriculture subcommittee's investigation of the Rural Electrification Administration, described by its members as "not a trial, but a fact-finding inquiry," has provoked considerable criticism as being unfair, particularly so to Robert B. Craig, former REA deputy administrator.

Committee counsel Carroll L. Beedy, who has been accused by Craig's attorney of unfairness in several respects, protests that the record is not yet complete and that criticism of it should thus be deferred. Committee members themselves have relaxed somewhat in their attitude as to what should go into the record, and a prepared statement which Craig originally was refused permission to put into the record is now before the committee "under advisement." Craig further has been promised that he may present any complaints to the committee "for consideration."

There appears no valid reason why Craig should not have been permitted to answer the long list of allegations against him in his own way when he was first called to the stand. This privilege, which seems fundamental in a true democracy, was denied Craig. Rather he was examined on some—not all—of these allegations by counsel for the committee, who controlled the form in which Craig's answers went into the record.

Committee members show themselves to be jealous of their right to follow the traditional Congressional investigatory pattern, in which witnesses have no active counsel and little control over the record. Should they not be even more jealous of their opportunity, if these be fact-finding investigations, to get all the facts so that in arriving at their ultimate findings they will not be accused of prejudice in deliberately concealing information?

Whether Craig has done himself as much good on the stand as he might have, even under the circumstances, is beside the point; he should not have been prohibited from taking up specific allegations and telling his side of the story concerning them in his own words, leaving the committee free to consider both sides and draw its own conclusion.

If such procedure be contrary to the traditions of the Congress, then perhaps, as one of the committee suggested, the tradition needs revision.

But it isn't only Craig who has had difficulty in getting a fair hearing in this case. The REA itself and its personnel have not had an opportunity to refute the allegations against them. The REA is going to continue and it must have the public's confidence if it is to do the best kind of a job. If there are bad spots in its operations they should be corrected after being aired in such a manner as to bring out not just part of the truth but the whole truth. The personnel of REA must not be left at the conclusion of this investigation too scared to do anything no matter how beneficial to rural electrification it might appear to be for fear it will be misconstrued later by some antagonistic Congressional committee without giving them an opportunity for explanation.

## Clarifying Depreciation Reserve Ownership

WHAT is the customer's stake in the depreciation reserve? This question has been bothering utilities and regulatory agencies for many years. An effort to shed some light on it has been made in an income statement recently issued by the Hartford Electric Company in which the reserve is shown as accruing in two ways, one directly as an operating expense, and the other as the equivalent of interest on the reserve at 3 percent. The total accrual is not changed, but the adjustment by treating borrowings from the reserve just the same as from any other source gives recognition to the customer pre-payments of property retirements.

If this practice gains favor, then the true meaning and purpose of depreciation reserves will become clear. Sometimes the company must retire property for any one of a number of reasons. When the retirement takes place the stockholders must be reimbursed by those who used up the property. The customers can either pay them in one big chunk or regularly in little pieces beforehand. The single payment is impractical and so the second method is used. But the reserve doesn't belong to the stockholders until paid out for retirements. Since it would be silly to let it stay idle, the company borrows the money and pays interest.

Who gets this interest? The customer. How? By paying interest at the market rate the reserve is built up faster and less therefore is required from the customer.

If this isn't convincing there is one further step a power company could take and that would be to refund the interest on the reserve to the customers each year. Of course, it would be expensive determining how much each would get and the amount would have to be made up by higher rates to maintan the reserve. While we don't recommend it, it would be a dramatic way of showing the true nature of the reserve that anybody could understand.

## *Washington Comment*

*By R. N. LARKIN, Washington Correspondent*

# On the Nose

STORIES of industrial miracles achieved under pressure of the war are legion. An equally astounding performance, concerning the electric power industry, came to light Feb. 7, through a Federal Power Commission release listing the peak load on principal utility systems in 1943.

This is a story of long-range planning and estimating, of calculated chance-taking whose tangible results can be measured in fighting ships now in action—or almost ready to fight—which otherwise would be months away from the water, in rubber and high-octane gasoline plants producing for war instead of being merely under construction.

### *FPC Dispute*

In October, 1941, there was furious dispute as to the war requirements of electric power. The Office of Production Management, whose power division was then small, was arrayed against FPC and other federal agencies which foresaw only disaster unless power equipment was rushed to completion in tremendous amounts. FPC had predicted a 1943 peak load of 42,715,000 kw. OPM set it at 37,400,000 kw. The abuse which rained down on OPM's figure was heavy.

FPC's recent release set the 1943 peak load at 37,063,961 kw. For the purposes of power supply calculation, however, the actual 1943 peak load was 37,252,000 kw., which is the sum of all non-coincident peaks at the end of the year. Area peaks were attained from August through December. Since area power supply must be calculated on the number of kilowatts which will be required in a given area in a given year, the sum of all area peaks at the end of the year is the more valid figure for OWU. WPB's 1943 peak, calculated 27 months in advance, was high by four-tenths of one percent. FPC's prediction 30 months in advance was 14.6 percent high on OWU's actual peak.

Seventeen months after its original estimate of 1943 peak, in February, 1943, a WPB review came up with a 1943 peak of 37,250,000 kw., so close to the actual 1943 sum peak that the difference can hardly be figured.

Again in July, 1943, six months before totals were in, WPB recalculated its estimated 1943 peak, setting it this time at 37,310,000 kw. This estimate proved to be 13/100 of one percent high.

The significance of these predictions is immediately apparent when it is realized that the power program was in direct competition with such programs as fighting and cargo ships for boilers, turbines, valves and generators, with synthetic rubber and high-octane gasoline plants for pumps, valves and boilers. It competed with everything for steel, copper, plant space and skilled manpower at a time when these things were tightest.

### *Acknowledgments*

This long-term sharpshooting of such phenomenal accuracy was almost entirely the work of the Power Forecast Section of WPB's Power Division, later OWU, headed by Constantine Bary, on loan from the Philadelphia Electric Company.* He credits five factors for its accuracy.

Part of it was luck. The original estimates, for instance, included 100,000 kw. of aluminum capacity, 100,000 kw. of steel capacity and 100,000 kw. of special ordnance work which failed to materialize in 1943. The resulting overestimate was offset by cancellation of the coastal military dimouts which added 300,000 kw. to the 1943 peak. There were other similar instances of sheer luck.

Part of the credit goes to executives of several operating utility companies who had the "pre-war vision" to finance the slow and painstaking research work on class-of-load characteristics over a wide range of energy use which was necessary for the calculations to have any basis of merit. It was as a result of this pre-war research that authentic relationships were established which were of real value in appraising the behavior of war loads.

Dr. Maurice Levin, formerly of OPM and WPB, gets part of the credit. It was in several conversations with Dr. Levin that Bary got his ideas on the inter-relationship between war loads and civilian load displacement which played a significant part in the forecasting of 1943 power requirements.

Part of the credit goes to FPC which made available to WPB comprehensive historic statistical data on utility system loads and energy output. This data was invaluable for trend analysis.

Part of the credit is due Bary for having developed methods of making load forecasts.

J. A. Krug, then chief of WPB's Power Division, and his staff brought to their jobs broad operating and engineering experience and the knowledge of the industry's problems which comes only with that experience. Their predictions and programs were assailed by some public and even a few private systems when WPB compared its estimates with those of major groups of electric systems.

### *The Power Lobby*

The reddest face must be that of "The New Republic" magazine, which, in April, 1942, carried an article titled "The Power Lobby Comes Back," reading, in part:

"Constantine Bary, of (WPB's) Power Unit, is playing into the hands of reactionary Congressmen who gobble up the short-sighted power-need estimates he hands them, refusing to consider as war projects any which cannot be completed within the next two years. Bary and his pals are gambling thousands of lives on this bet that our war needs will be a thing of the past two years from now."

No doubt the Marshalls' invasion fleet includes craft which are powered by the turbines, boilers and generators which WPB decided not to install at Ottumwa and points west—the power capacity saved in the big program slash of mid-1942 which was based, among other things, on Bary's "short-sighted power-need estimates."

* Mr. Bary is the author of the analytical study of the behavior of electricity system loads following the war which appeared in the January 8 issue of Electrical World under the title "Post-War Loads on Electric Utility Systems."

# NEWS OF THE WEEK

## Detroit Edison Tests 20% Gross Tax Levy

***Suit filed in Circuit Court of Wayne County to determine validity of city of Detroit's recent ordinance imposing 20 percent excise tax on utility gross revenues***

Detroit Edison Co. announced late last week that it has filed suit in the Circuit Court of Wayne County, in Chancery, to determine the validity of the city of Detroit's recent ordinance imposing a 20 percent excise tax on utility gross revenues.

### *Asks Prompt Decision*

Alfred C. Marshall, president, in making the announcement, said that the company wants as prompt a decision as the courts can properly give.

"We are taking this step," he explained, "not because of any desire to be unco-operative or to engage in a prolonged, delaying legal action, but because the proposed tax works a serious and unjustified economic injury to our company."

The ordinance which is being challenged was passed by the Detroit City Council on Nov. 30 and became effective Dec. 30. Purport of the tax, which is retroactive to Jan. 1, 1943, is to drain off excess profits taxes now paid to the federal government and use them to finance local post-war improvements. It would take more than $10,000,000 a year from the Detroit Edison Co.

### *Effect of Tax*

"The effect on us," Marshall explained, "is not simply to shift tax money from the federal government to the city; if that were the case we would be only a neutral stakeholder. Actually, the ordinance requires payment to the city of 20 cents out of every dollar of gross revenue, or more than $10,000,000 a year. While payment of this city tax would reduce our federal income taxes by about $8,000,000, it would result in an additional total tax burden on the company of about $2,000,000 annually."

In explaining the reasons for taking court action it was stated that the company cannot safely pay the great sums involved in advance of a court decision establishing the validity of the new tax because there would be no way to recover the funds paid, if the ordinance was later found invalid.

### *Tax Increase*

"The war has not increased our net income," Marshall asserted. "Our business is greater, but, as in the case of many other businesses, federal taxes have been sharply increased for the proper purpose of financing a large part of the war on a pay-as-you-go basis. The result is that our 1943 net income is $1,900,000 less than in 1940. The proposed utility tax would cut it $2,000,000 more, which amount is nearly one-quarter of our total net income for 1943.

"For the city to so materially cut the company's earning level contradicts the Michigan law permitting a utility to earn a reasonable return on money invested in its property. The ordinance singles out our company and one other (Michigan Consolidated Gas Co.) to carry the entire burden of this tax. I think that this tax is too radical in its method and result. A tax scheme of this kind would hurt Detroit and be a diversion of federal taxes in wartime," Marshall asserted.

"We feel compelled to challenge its validity and so have filed suit in the Circuit Court of Wayne County, in Chancery, asking that the ordinance be declared illegal and void," he stated.

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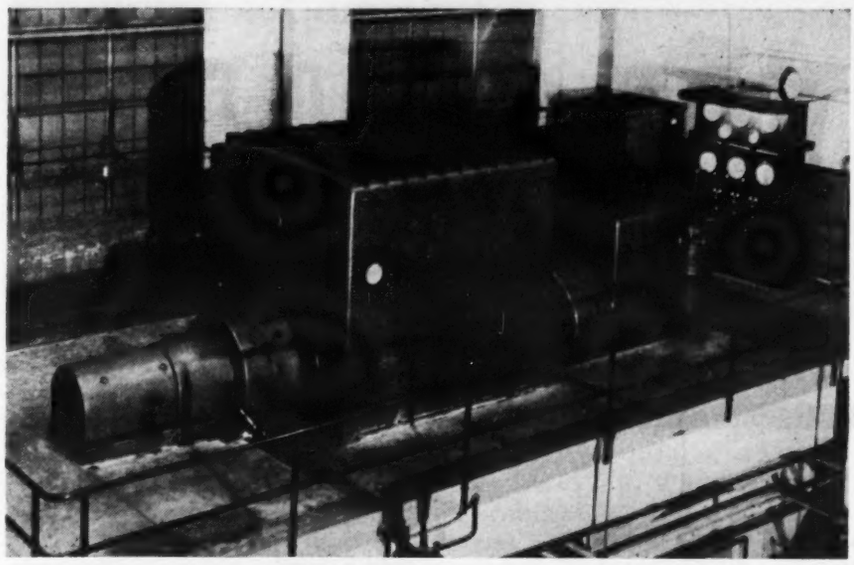
## CIO Union Petition Dismissed by Board

In a decision handed down last week in Washington by the National Labor Relations Board a petition made by the Utility Workers Organizing Committee, a CIO affiliate, to have the Pottsville division of the Pennsylvania Power & Light Co. set apart as a separate bargaining unit was dismissed.

Last week's decision affirmed a decision made by the Philadelphia regional office of NLRB earlier in the month on the same question.

Briefs were submitted by both the UWOC and the Employees Independent Association following preliminary hearings early in January before an examiner of the NLRB. The question involved was whether the P. P. & L. Co. shall bargain with labor's representatives on a system-wide basis or on a division-wide basis. UWOC argued that it should represent employees in the Pottsville division of the company, while EIA took the position that it, the recognized bargaining agent, should represent the employees of the entire system, including Pottsville. Dismissal of UWOC's petition re-established EIA as sole bargaining agent of all company employees.

John M. Houston, board member, said: "Consideration of . . . the long history of collective bargaining premised on a system-wide unit and the company's integrated business, impels the conclusion that the unit sought by the UWOC, limited to the Pottsville division, is inappropriate."



**NEW BEDFORD'S LATEST—Delayed by the war, New Bedford (Mass.) Gas & Edison Light's new 7,500-kw., 850-psi, 825-F., G.E. topping turbine unit is now in regular service at the Canon Street Station of this New England Gas & Electric Association utility. An air-cooled generator running 3,600 r.p.m. delivers 60-cycle energy at 13.8 kv., the cooler being located on top of the machine to save space below. Main and pilot exciter are direct connected to the unit, which is installed near two 125,000-lb. per-hr. B & W boilers serving the enlarged plant. Turbine exhaust at 200 psi is into the steam main supply for the older units of the station**

## Concession Settles Witness Controversy

Arkansas Department of Public Utilities suceeded in obtaining testimony from the Federal Power Commission in the DPU's investigation of the Arkansas Power & Light Co. to establish a rate base, although the DPU did not obtain testimony from the two witnesses it subpoenaed for that purpose.

After the FPC had declined to permit members of its staff to testify in the hearing, the DPU subpoenaed George T. Cross and Robert O'Neill of the FPC, who were in Arkansas preparing for a FPC hearing scheduled for March 16.

When these witnesses appeared at the DPU hearing room on Feb. 9 they were accompanied by Charles Shannon, chief counsel for the FPC, who bluntly stated that "these two witnesses are not going to testify." He suggested that the controversy be settled, "not on a legalistic basis." As a result, the Arkansas DPU requested that it be permitted to send an examiner to Washington to question Charles W. Smith, chief of the FPC Bureau of Accounts, Finance and Rates.

There were numerous conferences and late on Feb. 11 the Arkansas DPU received a telegram from FPC agreeing to the proposal to let Smith testify and to make available to the DPU the services of W. F. Spurrier, chief of accounts for FPC, to aid the DPU staff in preparing cross-examinations for AP&L witnesses.

In view of this concession by FPC the DPU waived its order subpoenaing Cross and O'Neill.

In suggesting to FPC that Smith be examined before a DPU examiner, Chairman A. B. Hill of the Arkansas Department pointed out that A.P.&L. had presented testimony in which witnesses expressed "opinions that certain Federal Power Commission interpretations of its system of accounts are in conflict with sound accounting principles."

Depositions to this effect were read into the record. They were testimony given by George O. May and Henry Thomas Sanders, expert accounting consultants, in which both declared "original cost" as the basis of value for a utility property was not in line with sound accounting principles.

The Arkansas department has ordered A.P.&L. to show why "original cost" should not be established as the rate base for the company.

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## 400,000 Share Award

Allen & Co. and associates won award of the 400,000 shares of Central Illinois Electric & Gas Co. common stock put up at competitive sale by Consolidated Electric & Gas Co. They bid $17.63 a share.

## Introduce Bill for Army Flood Control

Legislation calling for enactment of the Army Engineer Corps' vast flood control, navigation and power program for the Missouri and Upper Mississippi Rivers, giving the Army Engineers police powers over the water levels of publicly and privately owned power dams on all navigable streams and establishing a nation-wide soil conservation program, is slated for introduction by Sen. Bennett Champ Clark, Missouri Democrat, shortly, it was learned this week.

Under the bill, the Engineer Corps would have the duty of preventing recurrence of such situations as those experienced last May on the Grand River in Oklahoma below Pensacola Dam, where the dam was operating at peak water levels when fast-rising waters upstream swept down and over it before any effort could be made to catch any flood water.

The Engineers' plan for the Upper Mississippi and Missouri Rivers contemplates a 9-ft. navigation channel up to Sioux City, Iowa, and many multi-purpose dams on the Missouri. Cost of the entire program is estimated as high as $1,000,000,000.

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## Rubber-Covered Wire Requested of Board

That the emergency insulation wire is proving unsatisfactory in field practice and that as soon as the synthetic rubber program can provide the rubber it should again be used for insulation of building wire was the sense of a resolution passed by the Southern California Chapter, International Association of Electrical Inspectors, at its last meeting in Los Angeles.

"Field experience in the use of wire encased within this wartime insulation has proved that it is not a satisfactory substitute for rubber covering in that it breaks down under installation and does not provide a satisfactory degree of insulating safety," the resolution states.

In addition to such recommendation it was agreed by the members that as soon as word has been received from the WPB that sufficient synthetic rubber is being released to wire manufacturers to provide insulation in a quantity to meet the full demand, members of the chapter would set a specific date, after which they would accept no installations containing E.I. wire. That date would be based in such a manner to allow sufficient time for contractors and wholesalers in southern California to dispose of existing stocks of E.I. wire.

# Senate Subcommittee Hears Claude Wickard

***Secretary of Agriculture, at REA hearing, said REA objective is more than "mere serving of farmers with central station service"— Also helps social and economic development***

Agriculture Secretary Claude R. Wickard told the Senate subcommittee investigating the Rural Electrification Administration this week that REA "has objectives aside from the mere serving of farmers with central station (electric) service."

### *Other Objectives*

Wickard described these other objectives, which he said REA "has and should have," as the "furtherance of the development of social and economic welfare of people in rural areas."

The statement was made at the conclusion of nearly four hours of testimony by Wickard, who often refused to answer questions by Committee Counsel Carroll L. Beedy because he felt the answers were "not in the public interest." At one point Wickard testified that he had not made available to REA Administrator Harry Slattery a copy of a report by Agriculture Department investigators, on the basis of which, Slattery recently testified, he would have asked the dismissal of two engineers still with REA. Wickard said he "did not think it advisable" for Slattery to have the report.

Wickard opened the hearing by refusing to disclose, as "not in the public interest or in REA's interest," the names of the people with whom he discussed the appointment of William J. Neal as Deputy REA Administrator last summer.

Beedy asked Wickard whether he had investigated, in considering Neal, records of the REA co-op of which Neal was president which he said showed it one of the "poorest run" of all co-ops, with "a large deficit." Wickard said he had not known that, and denied that Neal's appointment was a political one.

### *Letter Introduced*

Beedy then introduced a letter allegedly written Presidential Secretary Steve Early in March, 1941, by Elliott Roosevelt, eldest son of the President, protesting against the lending of REA funds to finance a transmission line from Texas' Possum Kingdom Dam to the lines of several West Texas co-ops.

The letter charged that the board of the Brazos River Authority, which operates Possum Kingdom, had accepted a "substantially smaller offer" for the dam's output than that made by Texas Power & Light. The power went to a transmission co-op organized by several regional co-ops which ultimately built the line protested against. The writer said he understood the Brazos River Authority Board was warned that it would get no further federal funds if it refused the transmission co-op's offer, but that it would get $20,000,000 for downstream flood control and "a couple of defense plants" in the area if it accepted the co-op's offer.

Wickard did not recall having discussed the letter with Early.

### *Alleged Favoritism*

Beedy then read into the record lengthy excerpts from an investigation of the activities of Guy Thaxton and J. K. O'Shaughnessy, REA engineers, relative to alleged favoritism shown by them to copper conductor over aluminum. He asked why Thaxton was allowed to remain on the payroll, and read several letters between Thaxton and a private engineer in Texas, named Morrison, in which the former favored a partnership wherein he would direct business to the latter. In one letter Thaxton urged Morrison to boost fees charged co-ops for engineering services . . . Wickard testified that action had been taken which seemed warranted. He said Thaxton denied the charges.

Beedy then introduced a long letter to Wickard from Slattery, dated June 15, 1943, in which the latter said he had been "confidentially" informed of graft and collusion in connection with the Ark-La line, a co-operative project serving the Defense Plant Corporation's Lake Catherine, Ark., aluminum plant. Slattery asked permission to investigate, but was answered by Wickard that "I am not familiar with the facts in the Ark-La case and am not in a position to determine whether an investigation is warranted."

Asked whether this was not a "brush-off," Wickard said he wanted tangible evidence before authorizing an investigation of people so prominent as an ex-representative in Congress and an ex-member of the Arkansas Utilities Commission. He referred to Clyde T. Ellis, general manager of the National Rural Electric Co-operative Association, and Thomas Fitzhugh, counsel for the Ark-La Co-op.

### *Attack Credibility*

E. J. Stoneman, president of Wisconsin's huge Dairyland Power Co-operative, Mayor of Platteville, Wis., and a director of NRECA, closed last week's hearings with testimony reflecting on the credibility of John A. Becker, author of the "Becker Memorandum," on which so much of the investigation has dwelt so far. He added that NRECA had been organized to help REA fight utility opposition and that it could fight adverse legislation publicly, while REA could not do so because of the ban on political action by its people. He denied that NRECA would be unable to function without its original insurance scheme, and said the matter of purchasing domestic and farm appliances for members had never been discussed in NRECA's organization. He said NRECA had abandoned its two insurance companies, which were to have been financed with money loaned by co-ops.

Carl Hamilton, assistant to the Secretary of Agriculture, testified relative to an REA acquisition project which called for $2,805,600 for purchase of the Alabama Water Services Co. Hamilton said the project had been returned to him unapproved by Slattery because insufficient data accompanied the papers concerning it. Beedy's resultant attempts to show that Slattery had been by-passed with the appointment of Neal evoked little relevant response before Hamilton declined further testimony on the matter on the basis that Wickard, his superior, had refused to discuss the matter previously. The Alabama purchase has not yet been completed.

## Lift Priority Rating on Electrical Devices

Fuses and electrical wiring devices should be sold to retail customers without any priority rating, according to WPB's wholesale and retail trades division. Dealers may or may not use CMP regulation 9A to obtain their supplies of these items. Only rating required in the flow from wholesaler through to retail purchaser is that assigned the former on form WPB-547.

Meanwhile, WPB has ordered that distributors' purchase orders for these items bearing ratings of WPB-547 shall be filled after last week as though rated AA-2X. They may not be filled ahead of other orders placed before Dec. 30 which are rated AA-2X or better, however.

# See Settlement for Navy Generator Grab

***Negotiations between Navy Department and Dairyland Power Co-op concerning payment for two generators expropriated by Navy in 1942 near conclusion—$275,000 Co-op money tied up***

Negotiations between the Navy Department and the Dairyland Power Co-operative, of Genoa, Wis., concerning payment to the co-op for two generators expropriated by the Navy in May, 1942, were believed near conclusion this week, President E. J. Stoneman of the co-op, told ELECTRICAL WORLD.

### *In "Tough Spot"*

The Navy moved the two 4,000-h.p. generators and steam turbines off Dairyland foundations at the Genoa plant to a drydock in Puerto Rico, leaving Dairyland in "a tough spot," Stoneman said. He added that despite the Navy's plans to have them in operation by November, 1942, the first went on the line only last month. The other, he said, is producing power now, according to Navy officials.

The units were moved to Puerto Rico, apparently, not long before Gen. Philip B. Fleming, Federal Works Administrator, released for reassignment a 7,500-kw. steam unit originally ordered for the Puerto Rico Railway, Light & Power Co., which has at that time been expropriated by the Puerto Rico Water Resources Authority.

The unit was returned as not needed in Puerto Rico when the two private companies which had been expropriated were combined with the authority's hydro capacity. A Navy Department spokesman said the apparent confusion in sending expropriated units to Puerto Rico for Navy use, while a scheduled unit was being returned to the mainland as not needed there, had not been called to the department's attention.

### *New Priority*

WPB recently awarded Dairyland an AA-3 priority on a new 4,000-h.p. unit to go on the line in October.

Stoneman said the co-op had about $275,000 tied up in the two expropriated units alone and that it had about $1,100,000 invested in the total set-up for them. Since their removal, he said, the co-op has been unable to earn carrying charges on the investment, has not been reimbursed for the machines and has been forced to buy power from Northern States Power Co. and the Interstate Power Co. at a rate higher than that at which it sells its own energy.

Stoneman expressed the belief that the Navy's Bureau of Yards and Docks had made its decision to take the units over Dairyland's protest on the basis of a communication by a power company official who said Dairyland did not need the units. WPB's representative, Myles Carey, regional power supply engineer for that area, Stoneman charged was "not much help" in the matter. Stoneman said he apparently wanted the co-op to buy from a neighboring utility. Dairlyland, its president said, serves 22 co-ops, has 24 co-op members in three states, Minnesota, Iowa and Wisconsin, and has, in addition to several small hydro properties in Minnesota, two 3,000-h.p. high pressure steam units at Genoa and six 700-h.p. diesel-powered units at Chippewa Falls, Wis. He said a recent survey showed that 19 percent of the Nation's cheese production, 9 percent of its butter, and 7 percent of its poultry products come from farms served by Dairyland Power.

It is widely known at the Office of War Utilities that charges of discrimination against its regional representatives are not uncommon when equipment is refused. OWU, being charged with the distribution of equipment for which the demand has far outreached the supply, has been forced to order interconnections and resultant purchases of power in many instances when applicants felt they were entitled to generating or similar equipment. One OWU official said a report on the Dairyland situation by a public-ownership advocate sent into the region to check the matter had been severely critical of Dairyland's insistence that it be allowed to keep its two machines or to replace them.

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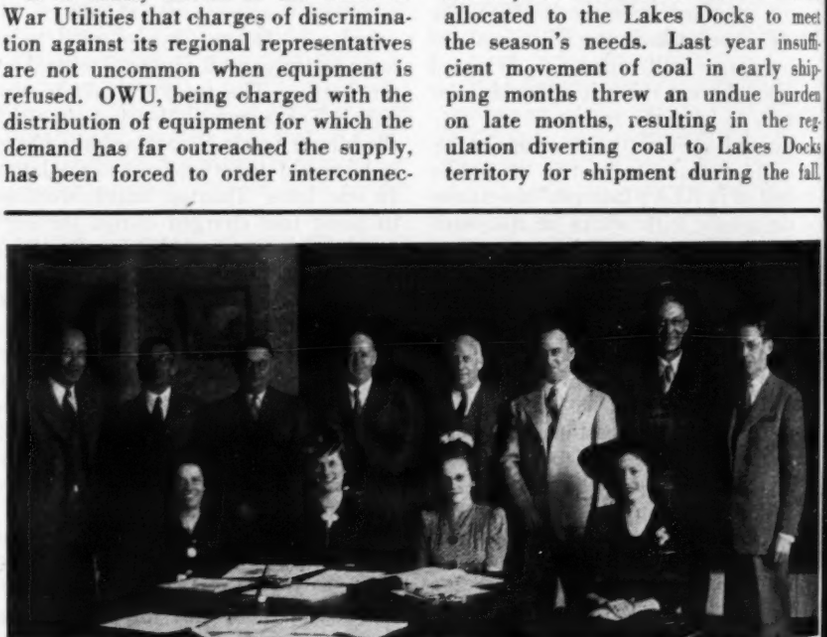
## SFA to Continue Regulation No. 10

Solid Fuels Administration Regulation No. 10, limiting the amounts of coal which electric utilities may purchase, has been continued without change through February and thus will affect contracts made this month for March delivery. Its provisions will be re-examined next month for possible lightening of the restrictions.

Meanwhile, SFAW Administrator Ickes has issued a new regulation governing coal shipments on the Great Lakes during the coming shipping season. Under the new rule contracts for coal so to be shipped must be made on or before Feb. 29. With such data in hand, SFAW will know how much coal has been contracted for by Lake delivery and how much more must be allocated to the Lakes Docks to meet the season's needs. Last year insufficient movement of coal in early shipping months threw an undue burden on late months, resulting in the regulation diverting coal to Lakes Docks territory for shipment during the fall.



**UTILITY EXPONENTS—Initial regional conference of New England Power System "Contact" correspondents in one of the divisions (Northeastern, North Shore and Mystic Valley districts) centering at Malden, Mass., and planned to enhance employee relations, public good-will and service to this notable house organ. Similar gatherings will continue around the system to dissipate the remoteness of mail and wire interchanges. L. to r., seated, Gladys Sulis, Revere; Gertrude Prendergast, Haverhill; Helen Lane, Amesbury; Mary Melvin, Lawrence. Standing, Frank Wood, Salem; Herbert Teel, Arlington; Joseph Nelson, Gloucester; Albert Banister, Lawrence; Hugh Lovering, Boston; John Conway, Lowell; Chester McKinley, Malden; W. L. Miller, "Contact" Editor, Boston.**

ASSOCIATION COMMITTEE MEETING—Transmission and distribution committee meeting of the Pennsylvania Electric Association in Philadelphia last week. Facts on which the distribution engineer can rely in post-war planning were divulged at the luncheon along with a forecast of load increases with a budget containing a 40 percent or better allocation to the "T & D" field

# Post-war Planning Data Presented to Committee

***Facts on which distribution engineers can plan post-war preparedness presented with preliminary data to T. & D. committee of the Pennsylvania Electric Association at meeting in Philadelphia last week***

Tangible facts on which the distribution engineer can plan post-war preparedness accompanied preliminary data presented to the transmission and distribution committee of the Pennsylvania Electric Association at a meeting in Philadelphia on February 10 and 11, 1944. Hopeful forecast of load increases with a budget containing a 40 percent or better allocation to the "T. & D." field was indicated by H. B. Bryans, executive vice-president of Philadelphia Electric, at a luncheon also attended by the P.E.A. executive committee.

### *Consumer Survey*

At another session J. F. Gaskill cited preliminary data from an incomplete survey of Philadelphia consumers: 80 percent of retail dealers have poorer lighting than 10 foot-candles and 97 percent will resume pre-war or better standards on removal of restrictions; among industrials 59 percent put lighting first, 28 percent heating first, 8½ percent will put up new buildings and 7 percent will increase production. Foundries and machine shops will resume pre-war consumptions, sheet metal plants will increase somewhat above their wartime peak, textiles hold firm and electric products slip off 10 percent, but still top pre-war by half. Industrial increments in general will, he conceded, be small by comparison with those following the earlier war. Farm incomes and savings will support the electrical purchases that will accompany the 600,000 miles of rural line to be built in the 3 post-war years, said J. R. Poteat (General Electric). Water systems have definitely increased dairy outputs. A range, a television set and a controlled water heater make a happy prospective load sequence. Electronic cooking is a potentiality to which much development money must first be applied. Poteat urged that utilities keep the public informed of their plans to prepare for the post-war demands. Hand in hand with this publicity must go a program of development, planning, sales promotion and sales training that will have to surpass any previous effort.

Unit substations have been an effective tool for consistent, economic distribution in the Philadelphia area, stated G. S. Van Antwerp. They have cost only two-thirds as much per kva. in the 1,000-kva. size as conventional substations and less than half in the 1,500-kva. size. Among 39 of the former and eight of the latter only three units have had to be removed for failure. One has made 54,000 tap changes without repair. The units bring high voltage close up to the load and lower the system investment without sacrificing operating reliability or flexibility, Van Antwerp said.

Industry production volume of unit substations has jumped from $1,800,000 in 1939 to $8,200,000 in 1942 and $22,000,000 in 1943, reported W. J. McLachlan (General Electric). He said the experience has taught the manufacturer how to achieve economy in production and assembly of heavy apparatus.

One company reported building an 18-mile, 66-kv. line with high ridgepins, wood braces, no ground, down wires or guys, to achieve impulse values not less than 2.4 in. per kv. phase to phase and 12.3 to ground. Analysis indicated the probability of a shattered pole not oftener than once in 7½ years.

An oil-filled cable (13 miles of 66 kv.) with 363 joints has had no failure since installation in October, 1942; gas leaks have been corrected and stop-joints redesigned to halt oil transfer.

Pole inspectors are 76 to 85 percent accurate in reporting remaining life in poles, according to a company which tested to destruction a stretch of idle 22-kv. line. Seven out of eight inspectors overestimate the extent of rot.

### *Step-Up Program*

The committee stepped up its program of furthering the standardization of pole-line hardware after representatives of producers (Hubbard, Joslyn, Oliver and Line Material) had offered full co-operation. It was shown that three of them collectively offer 39 styles and 226 listings of ridgepins, 48 styles and 391 listings of racks, whereas two ridgepins and four racks suffice for a typical company with a disposition toward simplification. Mere co-ordination of strengths of guy wire, clamps, conductors, poles, anchors, etc., would, it was asserted, help greatly in fixing on designs that would reduce inventories for both the utility and the manufacturer.

Earl Williams gave a working demonstration of the new Kyle automatic reclosing oil circuit breaker with positive hydraulic timing and thermal overload trip.

## Electrical League Holds Annual Meet

Managers of electric utilities in Colorado, Wyoming and New Mexico came to grips with planning problems involved in post-war bottlenecks and obstacles at the Rocky Mountain Electrical League's utility division winter meeting in Denver recently. The two-day session involved night conferences where hazards incidental to conversion of war power to peacetime production were carefully blue-printed and remedies delegated to skilled "trouble shooters," who were instructed to find solutions.

Looming as one of the grave threats to orderly resumption of business in the electrical industry is the immense stores of new and used electrical equipment with which speculators and government agencies will glut the market when released by restriction or abandonment of war projects. Sam G. Hardin, chairman of the League's distributor division voiced a warning that utilities, manufacturers and dealers alike will suffer; employment will be hampered and the public generally affected if a remedy is not quickly applied to control the situation. He advocated the creation of a federal board to administer the orderly absorption of the gigantic supply of goods, distribution of which, under existing methods, would develop into an economic calamity.

### *Serious Threat*

Another serious threat to the status quo of electric utilities was presented in a report by L. W. Edwards on behalf of the engineering division: Packaged diesel engine, wind chargers and gasoline engine competition for the patronage of small business and commercial customers. This situation was dropped into the lap of the power sales group.

President C. C. Baker, conducting the first meeting on the 1944 calendar, found himself confronted by an array of war-borne political, economic, engineering and accounting problems never before equaled in the history of the industry, and the foremost of these proved, when the subject was introduced, to be encroachment by government-sponsored power projects into domain heretofore serviced by private industry; REA's open defiance of state authority to govern cooperatives deriving funds from federal sources; paralleling of existing lines, acquisition of towns of more than 1,500 population; selling power at less than cost. Discussion disclosed that the Wisconsin Municipal Utilities Association and other organizations have taken action to compel REA to become law abiding and cease its waste and extravagance. Colorado's recent experience with two REA-sponsored cooperatives which denied jurisdiction of the State Public Utilities Commisison was a case in point; another was the forthright statement by H. C. Ivester, attorney for cooperative REA interests, before the Oklahoma Corporation Commission that REA proposed to drive private electric utilities out of business.

Even management of the utilities was under fire by the managers themselves when W. N. Clark, president, Southern Colorado Power Co. asserted that utilities are being out-smarted by employee representatives who have blossomed into full-fledged, crafty bargainers. He declared that the utilities are at a disadvantage in most negotiations because of a lack of talent capable of coping with these trained men—a condition which, he said, should be remedied with the least possible delay.

## MEETINGS

**Illuminating Engineering Society**—Canadian regional conference, Mount Royal Hotel, Montreal, Que., March 15. Leon Beauchamp, regional vice-president, The Solex Co., Ltd., 4060 St. Lawrence Blvd., Montreal, Que.

**Southeastern Electric Exchange**—Engineering and operation section, Henry Grady Hotel, Atlanta, Ga., March 23-24. John W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 3, Ga.

**National Rural Electric Co-operative Association**—Annual convention, Stevens Hotel, Chicago, Ill., March 20-21. Avery Moore, secretary, 416 5th St., N. W., Washington 1, D. C.

**American Institute of Electrical Engineers**—Northeastern district, Hotel Statler, Boston, Mass., April 19-20; national technical meeting, Jefferson Hotel, St. Louis, Mo., June 26-30. H. H. Henline, national secretary, 33 W. 39th St., New York 18, N. Y.

**Previously Listed**

**Great Lakes Power Club**—Winter meeting, Palmer House, Chicago, Ill., February 25. R. P. McClellan, secretary, Consumers Power Co., Grand Rapids, Mich.

**American Society for Testing Materials**—Spring meeting and committee week, Netherland Plaza Hotel, Cincinnati, Ohio, February 28-March 3. Robert J. Painter, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

**Council of Electric Operating Companies**—Annual meeting, Palmer House, Chicago, Ill., March 9. Tom P. Walker, president, Homer Bldg., 13th and F Sts. N. W., Washington 5, D. C.

**North Central Electrical Industries**—Second war conference sponsored by electrical trade groups, St. Paul Hotel, St. Paul, Minn., March 26-28. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

**American Society of Mechanical Engineers**—Spring meeting, Hotel Tutwiler, Birmingham, Ala., April 3-5. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York 18, N. Y.

**Edison Electric Institute**—Annual commercial meetings, Edgewater Beach Hotel, Chicago, Ill., April 3-5. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

**Missouri Valley Electric Association**—Engineering conference, Continental Hotel, Kansas City, Mo., April 6-7 I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln 8, Neb.

**National Association of Corrosion Engineers**—Annual conference, Rice Hotel, Houston, Texas, April 10-12. O. C. Mudd, acting secretary-treasurer, c/o Shell Pipe Line Corp., Box 2648, Houston 1, Texas.

**Electrochemical Society**—Spring meeting, Hotel Pfister, Milwaukee, Wisc., April 12-15. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

**Midwest Power Conference**—Palmer House, Chicago, Ill., April 13-14. Stanton E. Winston, director, Illinois Institute of Technology, Chicago, Ill.

**Missouri Association of Public Utilities**—Annual meeting, Jefferson Hotel, St. Louis, Mo., April 19-20. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

**National Electrical Wholesalers Association**—Second war conference, Stevens Hotel, Chicago, Ill., April 19-22. C. G. Pyle, managing director, 500 Fifth Ave., New York 18, N. Y.

**National Electrical Manufacturers Association**—Spring meeting, Palmer House, Chicago, Ill., April 24-27. W. J. Donald, managing director, 155 East 44th St., New York 17, N. Y.

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## Canadian League Continues Active

Additional restrictions imposed on the electrical industry across Canada in the last year were not reflected in any great degree in the operations of the Electrical Service League of British Columbia, acording to information presented by R. Hall, secretary-manager, to the annual meeting of the league at Vancouver, B. C., recently. Both industrial and residential building continued active and thereby provided avenues of activity for the league.

Last year the central station, manufacturers, jobbers and electrical contractors contributed $4,574.75 to the work of the league, and expenses totaled $3,957.42. The league has bought Victory Bonds to the extent of $2,600.

Post-war planning has been given wide consideration by the league and special committees have been appointed to study licensing, credit, salvage, codes, civilian supply, and personnel rehabilitation in the light of post-war conditions, as well as dealing with items of immediate import which are involved in realms covered by the respective committees.

Continual supply of information on industrial and commercial lighting has been maintained by the league, although lack of experienced personnel has presented difficulties in aggressive work in this field. The league records show, however, that efforts which have been made were responsible for sales of $175,000 in new lighting and wiring equipment, while sales of an additional $156,000 in equipment and wiring remain to be completed.

One important development of the year was the publication by the league of a portfolio dealing with adequate wiring. This was sent to builders, light companies and real estate agencies.

## Output Rises for Increase of 15.1%

The output curve increased noticeably for the week ended Feb. 12, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week came to a total of 4,532,730,000 kw.-hr., as compared to the figure of 4,524,134,000 kw.-hr. for the week previous, which ended on Feb. 5, 1944. Figures for the week represented an increase of 15.1 percent over the 3,939,708,000 kw.-hr. distributed during the corresponding week a year ago. Figures for the similar week two years ago were lower, the total being only 3,421,639,000 kw.-hr. for that period.

Again the seven major geographic regions of the country reported increases for the week and were about the same as similar periods for the corresponding week in 1943. The Pacific Coast region continued to lead the field with an individual gain of 27.7 percent. In second place, with a gain of 18.8 percent, was the Southern States region. The Mid-Atlantic region took third place with a gain of 14.2 percent. Low region for the week, with a gain of only 5.7 percent, was again the New England region. Gains or losses by the regions over a week ago continued to remain normal with no sharp variation. Greatest individual gain over the week in 1943 was 1.9 percent made by Southern States region.

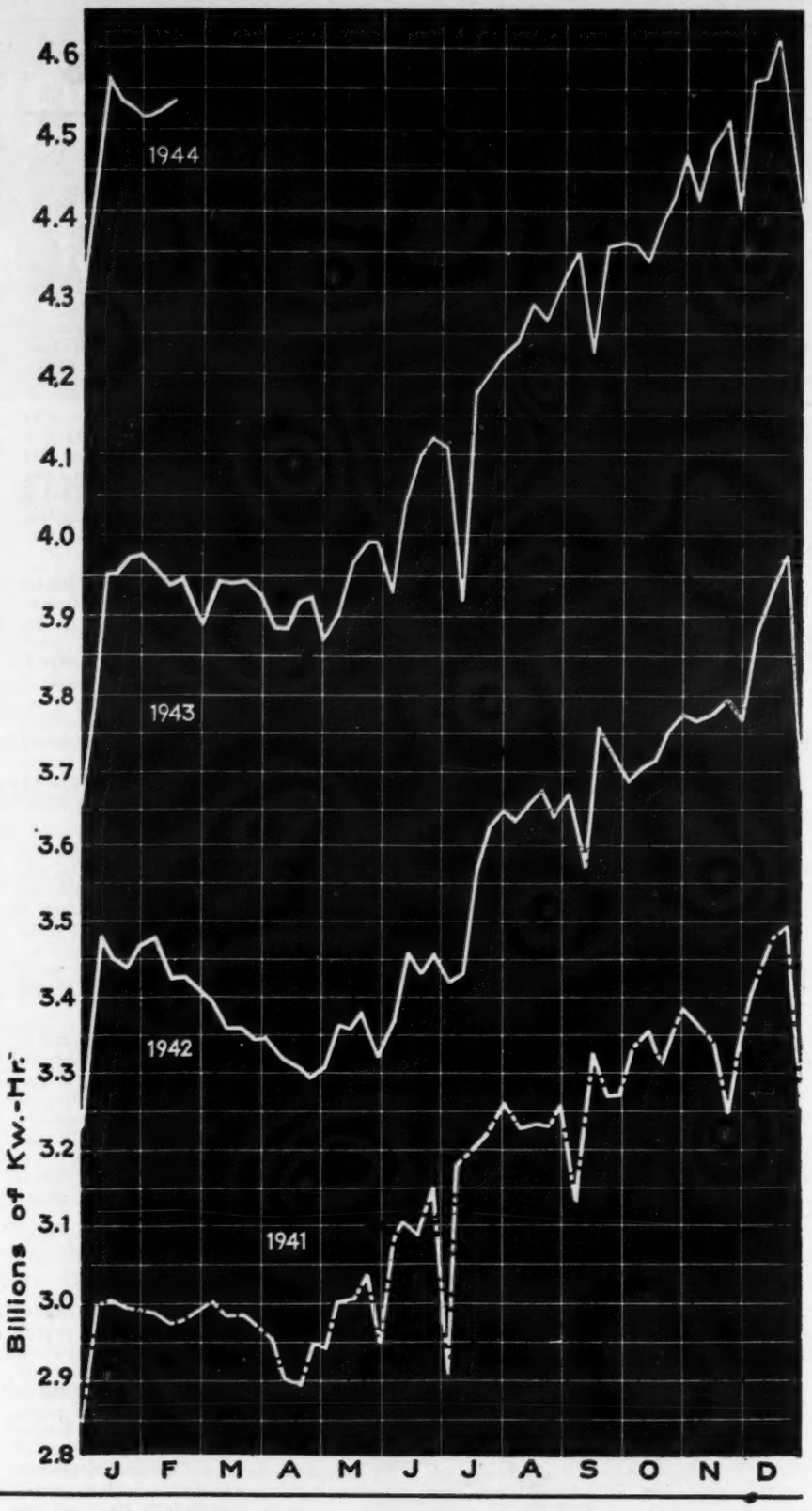
**Weekly Output, Millions Kw.-Hr.**

| 1944 | | 1943 | | 1942 | |
|---|---|---|---|---|---|
| Feb. 12 | 4,532 | Feb. 13 | 3,939 | Feb. 14 | 3,421 |
| Feb. 5 | 4,524 | Feb. 6 | 3,960 | Feb. 7 | 3,475 |
| Jan. 29 | 4,523 | Jan. 30 | 3,976 | Jan. 31 | 3,468 |
| Jan. 22 | 4,531 | Jan. 23 | 3,974 | Jan. 24 | 3,470 |
| Jan. 15 | 4,539 | Jan. 16 | 3,952 | Jan. 17 | 3,450 |
| Jan. 8 | 4,567 | Jan. 9 | 3,952 | Jan. 10 | 3,473 |
| Jan. 1 | 4,300* | Jan. 2 | 3,780 | Jan. 3 | 3,287 |
| 1943 | | 1942 | | 1941 | |
| Dec. 25 | 4,295 | Dec. 26 | 3,656 | Dec. 27 | 3,231 |
| Dec. 18 | 4,612 | Dec. 19 | 3,975 | Dec. 20 | 3,495 |
| Dec. 11 | 4,566 | Dec. 12 | 3,937 | Dec. 13 | 3,475 |
| Dec. 4 | 4,560 | Dec. 5 | 3,883 | Dec. 6 | 3,411 |
| Nov. 27 | 4,403 | Nov. 28 | 3,766 | Nov. 29 | 3,319 |

**Percent Change from Previous Year**

| | Week Ending | | |
|---|---|---|---|
| | Feb. 12 | Feb. 5 | Jan. 29 |
| New England | + 5.7 | + 5.0 | + 5.6 |
| Mid-Atlantic | +14.2 | +14.3 | +11.9 |
| Central Industrial | +10.9 | + 9.6 | + 9.1 |
| West Central | + 7.0 | + 5.4 | + 5.8 |
| Southern States | +18.8 | +16.9 | +15.8 |
| Rocky Mountain | +12.1 | +12.0 | +12.0 |
| Pacific Coast | +27.7 | +28.7 | +30.8 |
| Total United States | +15.1 | +14.2 | +13.8 |

*Subject to revision.




## Power Production Hits New High in 1943

Electric energy produced for public use, together with that produced by railroads, railways and publicly owned non-central stations, established a record high level in 1943 with a total of 220,776,000,000 kw.-hr., a preliminary report issued by the FPC states.

Production by water power in 1943 was 73,951,000,000 kw.-hr., or approximately 15.2 percent more than production by this means in 1942, the previous maximum year for hydro-electric generation. Production by fuel was up 17.5 percent over the corresponding total for 1942.

Coal consumed in the production of electric energy was about 79,665,000 tons, or 6.4 percent over 1942 consumption. Coal stocks as of Jan. 1, 1944, were 23.2 percent less than stocks on hand Jan. 1, 1943. Consumption of oil increased from that of the previous year, to about 18,085,000 barrels, or 18.3 percent more than the 1942 requirements.

# SEC DECISIONS-HEARINGS

The Securities and Exchange Commission, in a series of orders issued last week affecting electric utility companies:

DENIED TO THE Philadelphia Stock Exchange permission to grant unlisted trading privileges with respect to the $7 cumulative second preferred stock, series A, no par value, of the American & Foreign Power Co., Inc. The commission found that only 20,002 of the 2,570,186 outstanding shares of the American & Foreign Power stock were held by 508 holders in the States of Pennsylvania, New Jersey and Delaware, "an area much greater than the vicinity of the applicant Exchange." Because of this condition, the SEC said the stock did not qualify for listing in Philadelphia.

ORDERED ITS JURISDICTION released with respect to estimated fees of counsel in the matter of Public Service Co. of Colorado and Cities Service Power & Light Co., and authorized Power & Light to pay such fees in amounts not exceeding $45,000. The fees, which had formerly been set at $60,000, were for work in connection with the sale by Power & Light of the common stock of Public Service. The commission stated that in view of the nature and size of the transaction, the reduced fee was not unreasonable.

MODIFIED THE CONDITIONS contained in its order of Dec. 7, 1943, with respect to the issue and sale by Northern Indiana Public Service Co. of $1,400,000 principal amount of serial notes and by La Porte Heat Corp. of 3,750 shares of its common stock of the par value of $100 per share, to extend the time within which such transactions may be consummated to April 5, 1944. The sale involves the transfer by La Porte of its electric, gas and heat properties to Northern Indiana Public Service Co.

ORDERED THAT THE jurisdiction heretofore reserved with respect to the fees be dismissed in the matter of Florida Power & Light Co., American Power & Light Co. and Electric Bond & Share Co. The fees involved are (1) a fee of $15,000 proposed to be paid by Florida Power & Light Co. to the First Boston Corp. for services rendered in creating a market for its debentures and (2) a fee of $25,000 to be paid by the underwriters of Florida Power & Light Co.'s bonds and debentures for the legal services of Wright, Gordon, Zachry, Parlin and Cahill as counsel for said underwriters.

ANNOUNCED THAT electric and gas utility companies offered 42 securities issues during 1943, the smallest number in recent years. The total included 23 bond, two debenture, nine note and seven preferred stock issues aggregating $430,450,020 principal amount, compared with $375,979,353 aggregate for 57 securities issues in 1942 and $840,734,549 for 108 issues in 1941. Average coupon rate for bond issues during the past year was 3.44 percent, compared with 3.51 percent average for 27 issues in 1942, and 3.4 on the 61 issues of 1941.

### *Applications Filed*

REQUEST OF THE West Texas Utilities Co. of Abilene, Tex., to acquire all the property and assets of Pecos Valley Power & Light Co. in Abilene. Under the plan, each holder of Pecos Valley Power's outstanding bonds would receive his pro rata share of the proceeds, about 76 percent of the principal amount. Each holder of outstanding debentures would receive 18 percent and each stockholder $1 per share. Proceedings to foreclose a mortgage on the Pecos company were instituted by the New York Trust Co., as trustee in the District Court of Taylor County, Tex., on Jan. 21.

A POST-EFFECTIVE AMENDMENT to the plan of liquidation, pursuant to Section 11 (e) of the Public Utility Holding Company Act of 1935, for Utilities Employees Securities Co., a subsidiary of Associated Gas & Electric Co., Associated Gas & Electric Corp., and Associated Utilities Corp., registered holding companies.

REQUEST OF THE General Gas & Electric Corp. to authorize the payment out of capital or unearned surplus of a dividend on the 60,000 outstanding shares of its $5 prior preferred stock for the quarter ended March 15, 1943. The cash expenditures involved would be approximately $40,125, the company said, since the trustees of Associated Gas & Electric Corp., its parent, probably will follow its usual procedure and waive rights to collect the dividend on the 27,889.1 shares held by them, pending further order of the commission.

REQUEST OF North American Co. for authorization to pay another dividend on the standing shares of its common stock on April 1 to stockholders of record March 3 in shares of the common stock of Pacific Gas & Electric Co., par value $25, owned by it at the rate of one share of the latter stock for each 100 shares of North American common.

REQUEST OF Fred D. Ellis and Edmund J. Haugh of Chicago to approve the acquisition by them of 95,000 shares of the $5 par common stock of Northwestern Illinois Utilities, together with the unsecured promissory note of Northwestern in the present principal amount of $375,000 from American Utilities Service Corp., Northwestern's parent, for approximately $840,000.

### *Hearings Scheduled*

FEBRUARY 14: Proposal of the Indiana & Michigan Electric Co. to create a capital surplus account of $2,000,000 by a charge of like amount to its common capital stock account without any change in the number of shares of said stock now outstanding. It was also proposed that Indiana Michigan will, upon order of other regulatory bodies having jurisdiction over the accounts of the company, make various accounting adjustments in order to dispose of inflationary items presently included in its plant accounts which among other things will exhaust the capital surplus so created.

FEBRUARY 16: On the application of Electric Power & Light Corp. for authorization to use a portion of the proceeds of its recent sale of the common stock of Idaho Power Co. to acquire all or any part of the publicly held 65,167 shares of $6 first preferred stock of Mississippi Power & Light Co., its subsidiary. The commission approved last October Electric's original proposal to use the proceeds from the Idaho Power common stock sale for the acquisition and retirement of its own gold debentures, 5 percent series, due 2020. Because of market conditions, however, the company decided not to go through with this program for the present at least.

FEBRUARY 17: On the application of Republic Service Corp. requesting an extension of one year to comply with the commission's order of Feb. 19, 1943, to divest itself of all interest in, and all ownership and control of Page Power Co., Madison Power Co., Massanutten Power Corp., Massanutten Water Corp. and Holston River Power Co.

FEBRUARY 18: Applications filed by Consolidated Electric & Gas Co. and two of its subsidiaries, Athens & Sayre Gas Co. and Hagerstown Gas Co. Athens & Sayre, all of whose outstanding securities are owned by Consolidated, proposes to sell to H. Emerson Thomas of Westfield, N. J., and Mark Anton of New York, or their nominee, all of its properties and assets, for a basic price of $132,265, subject to adjustments. Hagerstown proposes to sell to Harrison & Co. of Philadelphia, or its nominee, all of its properties and assets, with certain stated exceptions, for $140,000 in cash.

•

## Plan Revision of Capital Structure

Long Island Lighting Co. announced last week plans for a comprehensive revision of its capital structure. Purpose is to provide for possible increased depreciation reserves and to facilitate the resumption of dividend payments on the company's outstanding preferred stocks, on which arrears totaled $9,188,431 at the end of 1943.

Under the terms of the plan, filed with the New York State Public Service Commission, the par value of the present 7 percent and 6 percent preferred stocks would be reduced to $60 a share and the capital surplus resulting from such reduction of about $10,000,000 would be available for future reserves in accordance with the Public Service Commission's requirements.

The Public Service Commission will hold public hearings on the petition.

## Utility Reports

| | Net Income 1943 | 1942 |
|---|---|---|
| *Columbia Gas & Electric and subs | $10,894,427 | $10,652,75 |
| *Detroit Edison and subs. | 8,791,014 | 7,837,72 |
| *Idaho Power | 1,225,851 | 1,334,21 |
| *Louisville Gas & Electric and subs | 2,893,684 | 2,793,99 |
| *Pennsylvania Water & Power | 2,114,697 | 2,225,90 |
| *Puget Sound Power & Light | 5,398,242 | 3,325,90 |
| *Southwestern Public Service and sub. | 691,292 | 807,50 |

*Twelve months ended December 31.

# G-E RENEWAL-PARTS SERVICE

## Is Tailored to YOUR Lighting System

### *Simplifies ordering parts*

### *Improves stock control*

G-E Renewal-parts Service enables you to set up a permanent system for reordering parts easily, accurately, and economically. It includes company-personalized Standardization Charts, Renewal-parts Bulletins, and the expert advice of G-E lighting specialists—all to assist you in stocking renewal parts and in standardizing your system.

### Ask Us about the STANDARDIZATION CHARTS

These illustrate and list the catalog numbers of the particular combinations of Novalux luminaires, brackets, and accessories that you use. They will aid your engineers and storekeepers in stock control and standardization of equipment. We will prepare these charts in the form and detail that best suit your purpose.

### G-E RENEWAL-PARTS BULLETINS Give Detailed Information

These contain complete parts data on the most commonly used forms of luminaires. You can obtain these publications for your Novalux luminaires without cost.

### How to Obtain This Service

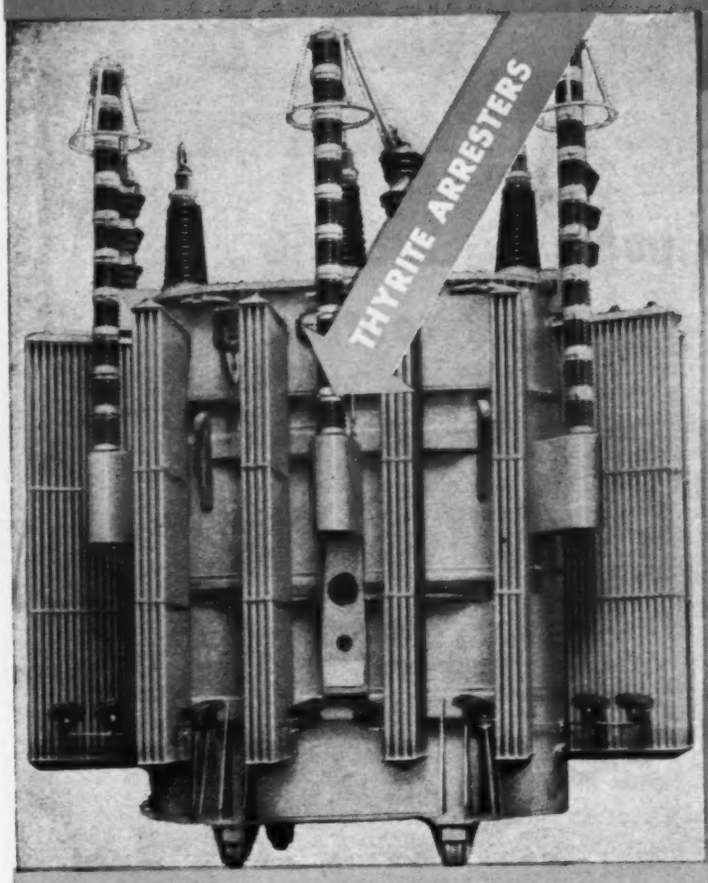
Call the nearest G-E office. A lighting specialist or sales engineer will assist you in assembling the necessary data for the Standardization Charts and in selecting the proper Renewal-parts Bulletin for your equipment. We'd like to help you with your lighting problems.

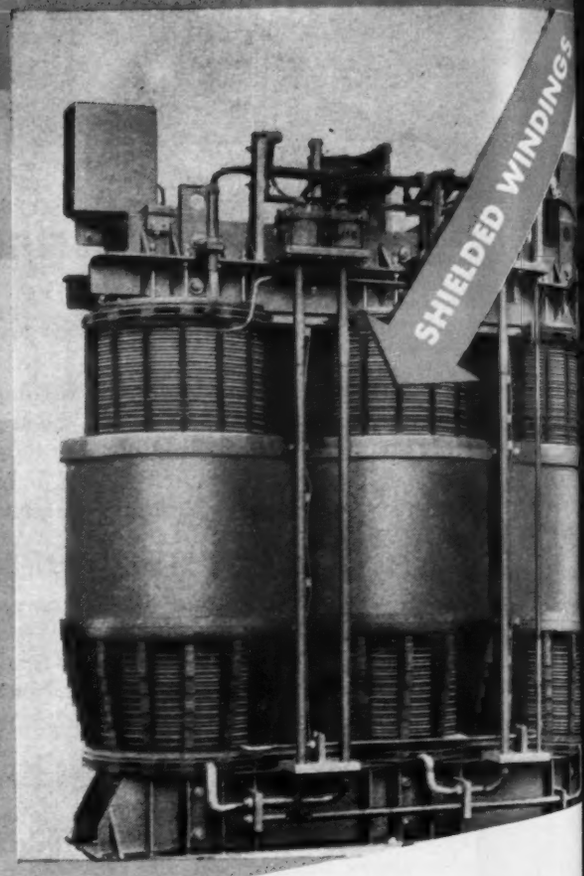
### Send for Our New RENEWAL-PARTS CATALOG

This new catalog will help you in identifying and ordering the most commonly used renewal parts. A pictorial index makes it easy to identify the luminaires you use and the parts you need. Send for a copy today —No. GEA-4084. *General Electric, Schenectady, N. Y.*

**GENERAL ELECTRIC**

# Co-ordinated for protection



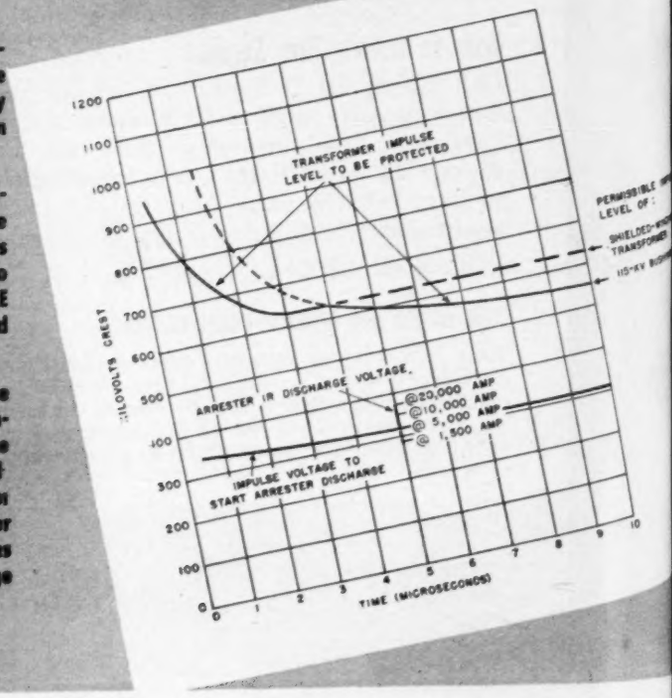




**THYRITE* LIGHTNING ARRESTERS** reduce lightning impulses and voltage surges to values safely below the impulse-test level of the transformer. Note how they can be mounted on the transformer—co-ordination in appearance as well as function

**SHIELDS** around the high-voltage winding of the transformer are connected to the line terminal. These shields properly distribute voltage impulses and surges throughout the winding, keeping internal stresses to values well within the strength of the insulation. G-E power transformers 44 kv and higher have shielded windings.

**CO-ORDINATED PROTECTION CURVES** show the impulse protection level of Thyrite station-type arresters compared with the transformer impulse level to be protected. These curves apply to a 115-kv shielded winding transformer protected by a Thyrite arrester for a 115-kv grounded-neutral system. This arrester will withstand lightning discharge currents as high as 100,000 amperes, and still hold the lightning voltage below the impulse-test level of the transformer.

*Reg. U.S. Pat. Off.



# that takes the destructive power out of ghtning impulses and switching surges

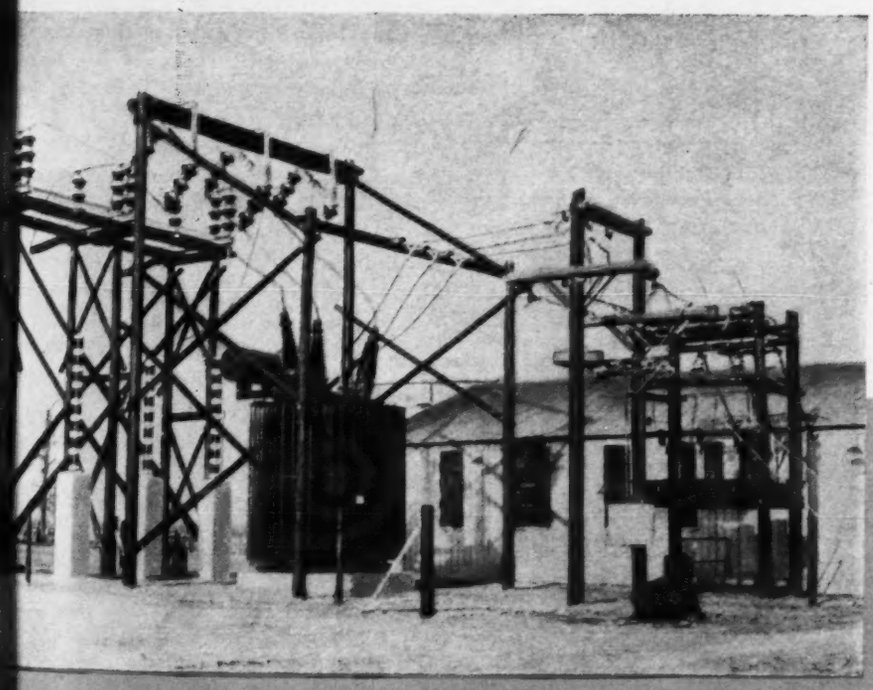
**CO-ORDINATED FOR PROTECTION"** means that he arrester limits the lightning or switch-ng-surge voltage which can reach the ransformer, and the shielding distributes he voltage harmlessly throughout the inding.

1. Thyrite station-type lightning arrest-rs limit impulse voltages to demonstrably w values—predetermined over a wide ange of wave fronts and discharge-current agnitudes.

2. The shielding in G-E power trans-rmers, by distributing throughout the inding the voltages allowed by the ar-ster, prevents abnormal concentration of ress regardless of the wave shape or fre-uency of the incoming surge.

**FOR DEPENDABLE PROTECTION** use *both* of these modern means of preventing damage to power transformers. More than 2600 G-E shielded-winding transformers — totaling more than 24,000,000 kva—are now serving the nation, helping to insure uninterrupted production. Many thousands of Thyrite arresters, installed on circuits from 2.3 kv to 287 kv, are providing unexcelled protection —preserving transformers and other vital electric equipment that is delivering indispensable power.

**FOR FURTHER INFORMATION** on G-E shielded-winding transformers, ask for Bulletin GEA-2305; on Thyrite lightning arresters, GEA-1304. *General Electric Company, Schenectady 5, N. Y.*



POWER TRANSFORMERS
AND
LIGHTNING ARRESTERS

**← PROTECTION on the "Big Inch"—Shielded windings and station-type, Thyrite lightning arresters are doing their part to prevent station outages on this famous pipe line. It's a responsible job, when you consider that just one station outage would reduce the output of the entire pipe line by 35 per cent.**

**GENERAL ELECTRIC**

401-16-5155, 5060

*ery week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.*

# HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

## Cable Racks Support Control Cable Trays

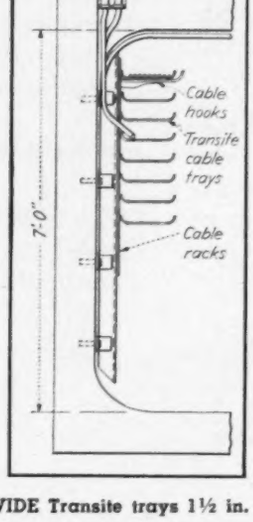
By J. S. BROWN
Duquesne Light Company, Pittsburgh, Pa.

Further details concerning the installation of Transite trays for control cable in the control cable tunnels of the Frank R. Phillips power station (ELECTRICAL WORLD, October 16, 1943, front cover) are shown in the accompanying detail and cross-section drawings.

The trays are made as round Transite, deformed to a flattened tube $\frac{5}{16}$-in. thick before the cement sets, and later each tube is cut lengthwise to make two trays. Supports are supplied every 5 ft. and are underground cable hooks inserted into "T" holes in underground cable racks.

Trays are all 12 in. wide and mounted out 4 in. from tunnel walls to give space for riser cables in back of the trays. The front edges of the trays are left open and unobstructed so that control cables can be easily installed or removed. Method of installing is either to lay cable on the floor and lift in place or to pull directly into the trays.

Although control cable trays in this plant were used largely in tunnels, they are practical and of neat appearance and can be very generally used throughout a plant, especially if they are purchased in a variety of widths. They cost less than trays made of sheet steel and do not require painting or other maintenance.




**FOOT-WIDE Transite trays 1½ in. deep on 4½-in. centers (capacity 15 trays on each side) carry control cables**

**Supports provided for racking additional cables along ceiling. Tunnel is 7 x 7 ft. Slotted cable racks attached to 3½ x 3½ x ⅜-in. angle; welded-on clips (at 18-in. centers) fastened to wall with cinch anchor and 6-in. bolt**

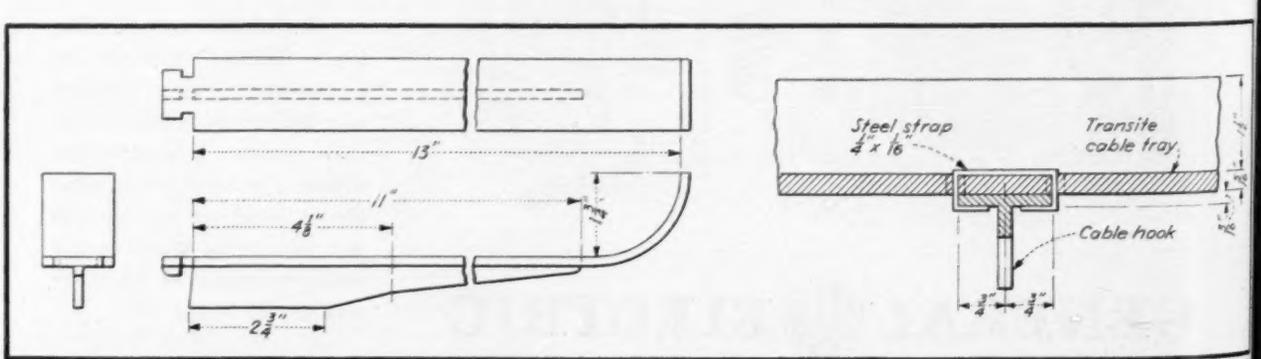
•

## Boiler Ratings Upped by Furnace Changes

Improved methods of firing, selected to take full advantage of boiler capabilities, are prominent among the resources available for increasing the capability of older type boilers. Through such increased capacity, often obtained with a marked reduction in furnace maintenance, greater loads are being sustained for longer periods by stations in important war production areas.

A case in point concerns Tulsa station of the Public Service Company of Oklahoma. Before the installation of spreader stokers on five of nine boilers at this plant it was necessary to reduce station load to permit maintenance of any one boiler.

With the installation of spreader stokers on existing traveling chain




**CABLE HOOKS fabricated from 1½ x 1½ x $\frac{3}{16}$-in. T-iron fitted into every third T-slot in standard cable rack (left). Trays fastened to hooks by piece of ¼ x $\frac{1}{16}$-inch steel strap (right)**

# *New* INTERNAL-PIVOT PANEL INSTRUMENTS

## 2½- inch—1 inch deep

For radio and other communications service: Type DW-51 d-c voltmeters, ammeters, milliammeters, and microammeters; Type DW-52 radio-frequency ammeters (a-c thermocouple-type). Cases are brass or molded Textolite.

## A New Design That Puts More Instrument into *Less* Space

These new, internal-pivot instruments were developed to fill a vital need—particularly in the radio and aircraft fields—the need for compactness. They are *thin*—in most ratings, less than 1 inch deep.

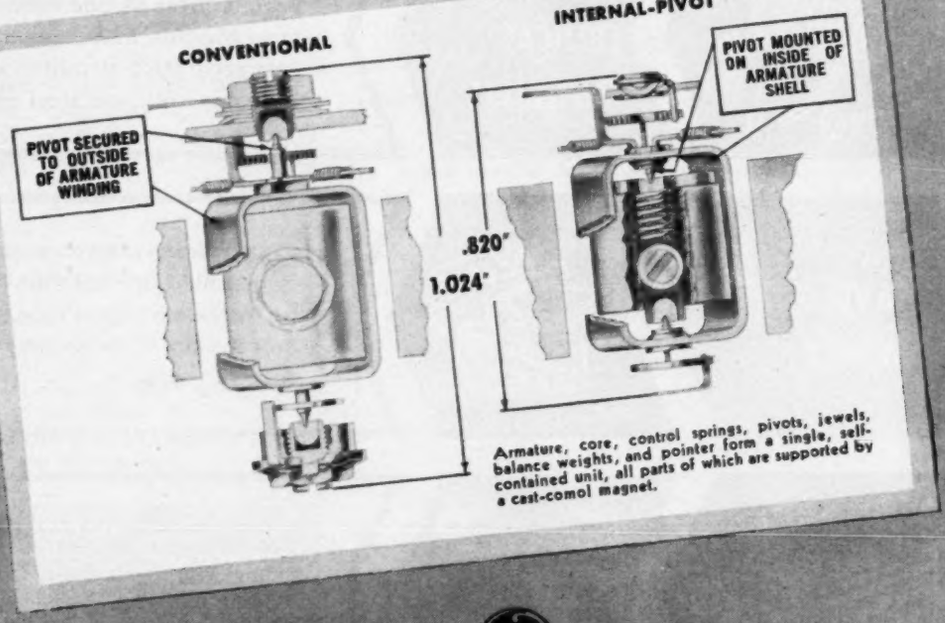
More important is the way their thinness was achieved. In the sketch below, see how the pivots are solidly anchored to the *inside* of the armature shell so they cannot work loose. The moving parts are permanently aligned with stationary parts by bolting the core assembly to a one-piece cast-comol magnet.

Other features are: large-radius pivots, high torque and good damping, lightweight moving element, and ample clearances. Added up, they give you an instrument well able to withstand vibration and hold its rated accuracy, one that is fast on response and easy to read accurately—a design that packs all-round fine performance in a small space.

For ratings, price, and dimensions, ask our nearest office for Bulletin GEA-4064, which covers instruments for radio and other communications equipment; or Bulletin GEA-4117, which describes those suitable for naval aircraft. *General Electric Company, Schenectady, N. Y.*

Type DW-53 d-c voltmeters, ammeters, and volt-ammeters that are specially designed to measure voltage and current in battery and battery-charging circuits on naval aircraft. They meet applicable Navy specifications.

*Invest in your future*
*BUY WAR BONDS*

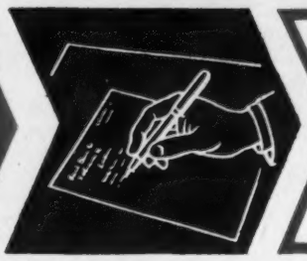

CONVENTIONAL
INTERNAL-PIVOT
PIVOT SECURED TO OUTSIDE OF ARMATURE WINDING
PIVOT MOUNTED ON INSIDE OF ARMATURE SHELL
.820"
1.024"
Armature, core, control springs, pivots, jewels, balance weights, and pointer form a single, self-contained unit, all parts of which are supported by a cast-comol magnet.

**HEADQUARTERS FOR ELECTRICAL MEASUREMENT**

**GENERAL ELECTRIC**

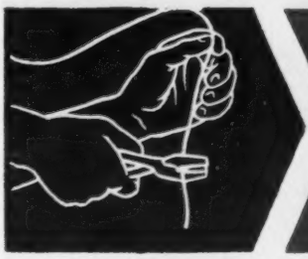
# You Save[1] and Save[2] and Save[3]

**1 SAVE ORDERING TIME**



Instead of buying two separately mounted devices—a motor-circuit switch and a magnetic starter—you buy one factory-co-ordinated unit that controls and protects your motor. Simply specify the motor rating and indicate the type of motor-circuit switch you want—and we'll send you the control you need.

**2 SAVE INSTALLATION TIME**

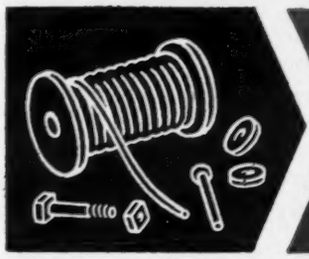


Users report a 50 per-cent reduction in mounting time, 40 per-cent reduction in wiring time, as compared with the installation of two separate devices. You mount one device—not two. You connect only nine terminals—not fifteen. You get your motors into operation quicker.

**3 SAVE MAN POWER**

By eliminating one complete mounting job on every installation, you save valuable man power. And because the cover cannot be opened while there is power on the starter, your men have more protection against accidental injury.

**4 SAVE CRITICAL MATERIALS**

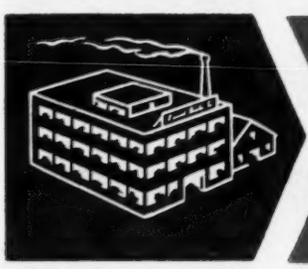


By buying both the motor-circuit switch and the magnetic starter as one compact unit, you save copper wire, steel conduit, and fittings that are necessary for installing two separately mounted devices—plus the saving gained by using only one steel enclosure instead of two.

**5 SAVE MONEY**

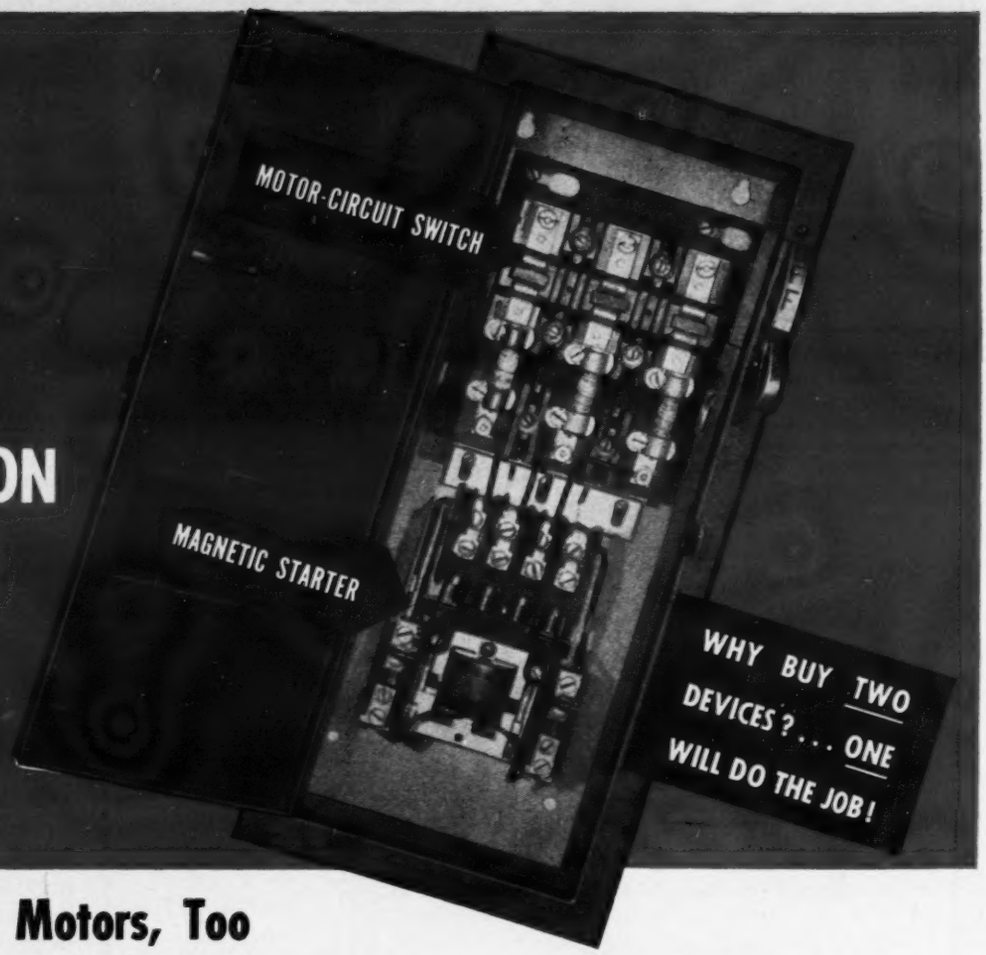
Combination starters cost slightly more than two separately mounted devices, but this difference is more than made up by the savings in wire, conduit, fittings, and installation labor costs. This statement is based on the actual experience of users.

**6 SAVE PLANT SPACE**



Combination starters take up less mounting space than separately mounted safety switches and starters. Because of this you can mount them in small, unused places near the operators.

# ...and Save[4] and Save[5] and Save[6]...




GE

## COMBINATION STARTERS

## ...and Save Your Motors, Too

...th G-E combination starters, you're sure that the ...tor-circuit switch or breaker has the proper rating ...interrupting capacity for the magnetic starter ...h which it is used. The fuses or breaker are co-...inated with the thermal overload relays to give ...plete motor protection under short-circuit or ...rload conditions.

...the simple, logical way to get control and pro-...tion for your motors—in one compact, easy-to-...all unit. Why buy two devices, when this one will ...the job?

### ...E YOUR HAZARD

...combinations come in enclosures to meet any ...rating condition: dust-tight, watertight, oil-im-...sed, general-purpose, or for hazardous locations. ...ilable for motors from 1 to 1000 horsepower.

Next time you order motor control, save seven ways by specifying General Electric combination starters.
*General Electric Company, Schenectady, N. Y.*

***Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.***

General Electric Company, Section G676-129
Schenectady, N. Y.

Please send me the bulletins checked below:

- GEA-3715—Combination starters: general-purpose, watertight, and dust-tight
- GEA-3660—2300-volt combination starters
- GEA-3804—Combination starters for hazardous locations
- GEA-3541—Oil-immersed starters

Name.....

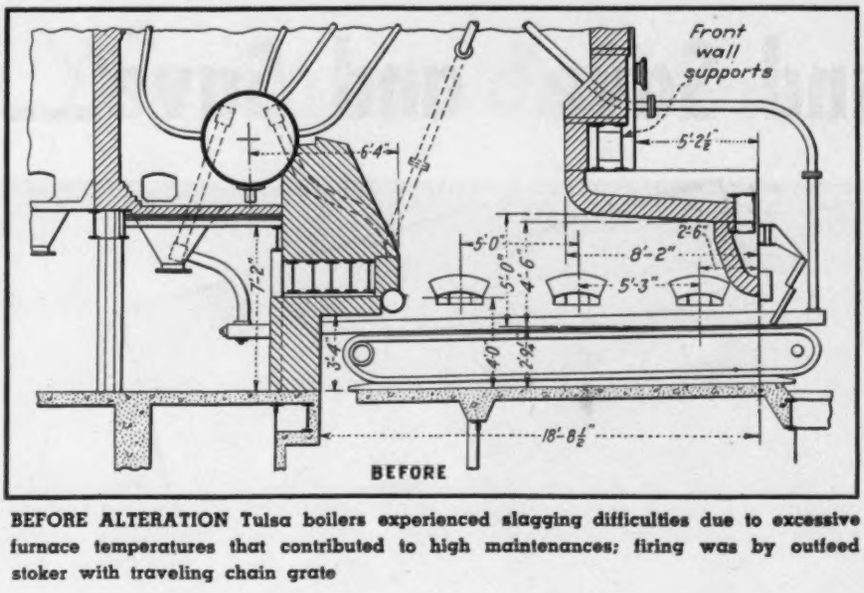
Company.....

Address.....

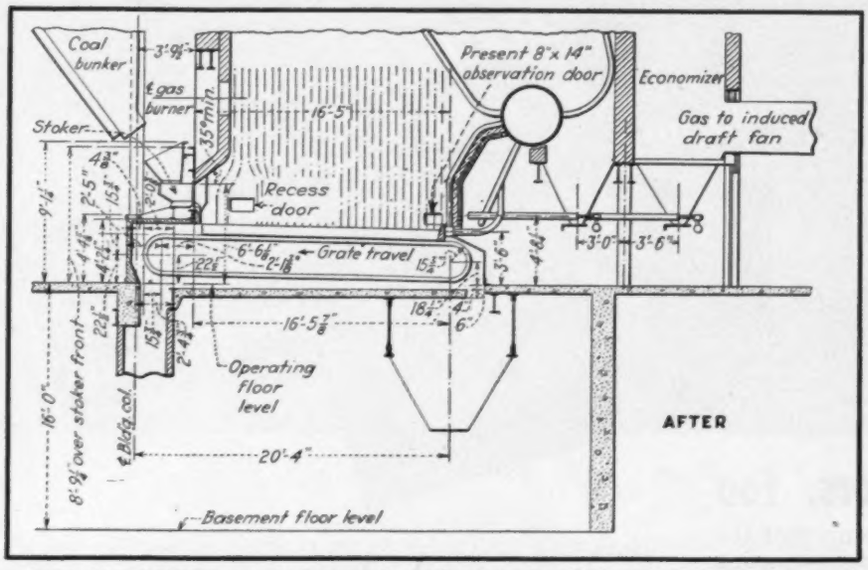
City.....State.....

8928

...ENERAL GE ELECTRIC




**BEFORE ALTERATION** Tulsa boilers experienced slagging difficulties due to excessive furnace temperatures that contributed to high maintenances; firing was by outfeed stoker with traveling chain grate




**AFTER ALTERATION,** in which spreader stoker was installed, travel of grate reversed, front wall extended 5 ft. and water walls added

grates in three of the boilers, and the addition of both spreader stokers and new chain grates on the two that had been previously gas/oil fired, capacity of these boilers was increased to between 90,000 and 110,000 lb. per hour.

This increased capability now permits eight of the station's nine 250-psi., 590 F. boilers to carry full station load during limited maintenance periods. Three of the five modernized boilers were formerly equipped with traveling grate stokers. These were capable of delivering 70,000 lb. of steam per hour at 250 percent rating. However, they could not deliver 60,000 lb. per hour continuously for more than 60 days without maintenance.

This article concerns chiefly the changes in the three Sterling type 890-hp. boilers at Tulsa station equipped with existing chain grates, and to which spreader stokers were subsequently added. Several conditions contributed to the high maintenance experienced on these boilers, among them: (1) Excessive slagging of boiler tubes, (2) erosion of the over-fire arch and (3) heavy slag accumulations on the bridge wall.

It was evident that trouble lay in furnace temperatures which exceeded the fusion point of ash and were attributed to a high heat release per unit of furnace volume. This gave in to excessive slagging, erosion of side walls and considerable furnace maintenance.

To correct the situation the existing feed arrangement was dismantled, leaving the chain grate as it was. Direction of grate travel was reversed, however, to dispose of ash in the front of the furnace. With the adoption of a spreader stoker, this arrangement got rid of the hot spot under the "over-fire" arch. The spreader stoker gave more uniform heat release over the entire grate area.

### *Water Walls*

By moving the front wall of the furnace out about 5 ft. the length of the over-fire arch was reduced and furnace volume was increased. Water walls (about 1,000 sq.ft.) were installed on furnace side walls reaching 14 ft. above grate level and on the bridge wall from the mud drum to grate level. This feature reduced the likelihood of slag deposits.

Coincident with these changes, the size of the forced-draft fan motors was increased from 20 to 50 hp. and the speed increased from 900 to 1,200 r.p.m. Motors on induced-draft fans were increased from 60 to 125 hp. and from 720 to 875 r.p.m. Unlike the forced-draft fans, the induced-draft fans required a change in impeller size.

While cinder catchers were not installed on these boilers, means were provided for reinjecting cinders into the furnace. This contributed to turbulence over the fire and resulted in more efficient combustion.

### *Two Other Boilers*

Similar alterations were made in the two formerly gas/oil-fired boilers mentioned, with the exception that it was necessary to install new traveling chain grates in these units in addition to the spreader stokers.

Since the modernization of these five boilers it has been possible to operate individual units at steam rates ranging from 90,000 to 110,000 lb. per hour continuously using the same 11,500 B.t.u. coal as formerly. Slagging of tubes and outages for cleaning have been completely eliminated. Soot blowers formerly busy are now idle. Cumulative result of these alterations is that Tulsa station can now deliver its full capability for sustained periods without incurring maintenance difficulties that reduce station capacity for short periods.

# FOR UTMOST WIRING PROTECTION

## GENERAL ELECTRIC RIGID CONDUIT

General Electric offers two conduits—each a leader in its class. Uniform high quality and dependability are assured by modern manufacturing processes and skilled craftsmen.

***G-E WHITE RIGID CONDUIT*** is hot-dipped galvanized and Glyptal-coated inside and out. This method of manufacture provides a heavier coating of zinc than could be applied in any other way and bonds the zinc to the steel.

***G-E BLACK RIGID CONDUIT*** is coated inside and out with tough asphaltic-base enamel which remains chemically inert in the presence of corrosive liquids or fumes.

G-E Conduits are made of mild steel tubing and are easy to bend and to install. Proper boxes and fittings are available.

### FOR FURTHER INFORMATION

On G-E Rigid Conduit, Electrical Metallic Tubing, Building Wire or Wiring Devices, see the nearest G-E Merchandise Distributor or write to Section CDW-245-9, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

***BUY WAR BONDS***

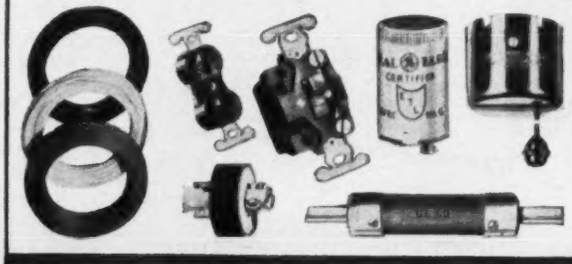
## G-E ELECTRICAL METALLIC TUBING

G-E high quality electrical metallic tubing is ideal to use for wiring system protection when chances of mechanical injury or corrosion are not severe. It is manufactured from open hearth steel and is electro-galvanized on the outside and black enamelled on the inside. It bends easily and accurately. Compression fittings are available.

***HEAR*** the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC. "The World Today" news every weekday 6:45 p.m. EWT, CBS.

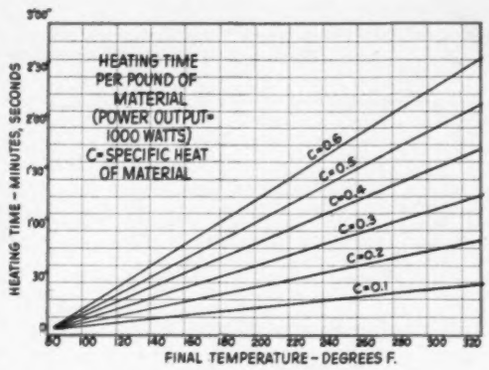
## G-E BUILDING WIRES AND WIRING DEVICES

Included in the G-E line are building wires and wiring devices for every purpose: Flamenol* Type SN small diameter building wire with thermo-plastic insulation, other wires and switches, lampholders, outlets, fuses, etc.
**Reg. U.S. Pat. Off.*



**GENERAL ELECTRIC**

# DO YOU HAVE A FAST, UNIFORM,




● *Estimates of heating time and power required for a given job can be based on this chart.*

● *Here's the compact RCA 15B generator—output 15 kilowatts, about 48,000 B.T.U. per hour.*

**How Does Electronic Heating Work?** Many substances which are electrical insulators for direct current or low-frequency alternating current tend to become conductors when subjected to high-frequency alternating currents. Substances vary, of course, but in general this effect becomes noticeable at frequencies above 1 million cycles per second, and increases as the frequency increases.

Thus, if sufficient current can be passed through the substance, an appreciable heating effect will be noted.

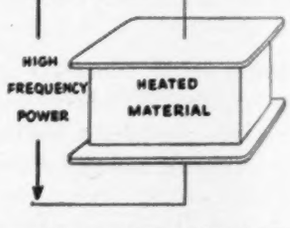
**What About Results?** *Uniformity:* If the current is uniformly distributed as it flows through the heated substance, the heating will be uniform—*not just at the surface, but all the way through the material.*

*High Speed:* This makes high-speed heating possible, since there is no delay caused by waiting for heat to seep from the outside to the inside of the piece.

*Better Quality:* With some materials the critical temperatures and the heating-time cycle are closely linked, so that external heating methods, which produce uneven heating, will cause varied chemical composition, and will often leave internal stresses in the material when it has cooled.

**How Is Heat Applied?** The substance to be heated is placed between two metal plates, and high-frequency power is applied across them.

The plates form an electrical condenser (or capacitor), and the heated substance is the "dielectric" of the condenser.




**Where Can It Be Used?** *Material:* This unique method of heating, called "dielectric" heating, can be applied to a wide variety of substances, such as: wood, plastics, rubber, foods, tobacco, ceramics, textiles, paper, chemicals, and many others. Some materials will heat better than others.

*Shape:* Dielectric heating is best applied to objects of uniform thickness, cross section, and composition. Some flexibility is possible, however. For example, plywood can be heated (for bonding) between curved plates.

*Thickness:* Heating is uniform regardless of the thickness of the material; that is, a thick piece can be heated as uniformly as a thin piece. Thus, this method is especially advantageous for thick sections.

*Area:* There are some restrictions as to the area (not volume) that can be heated at one time due to electrical limitations. Large areas may in some cases present problems.

*Volume:* The volume of material that can be heated at one time depends on several variables: material to be heated, speed required, power unit available, type of process (batch or continuous).

# PROCESS THAT NEEDS ELECTRONIC HEAT?

**Is Electronic Heat Efficient?** Electronic generators convert from 50% to 75% of the power-line energy they use into high-frequency power that can be delivered to the load. Since there are no platens to heat, and since the heating cycle is usually so short that radiation and conduction losses are very low, nearly 100% of the high-frequency power delivered to the load is converted into *useful* heat.

**How Much Power Is Needed?** The formula: $P = 2.93 \times 10^{-4} MCT$ gives the kilowatts needed to heat a substance, where M = pounds per hour of material; C = average specific heat of the material; and T = temperature rise in degrees F. Several other factors must be considered in order to determine the actual electronic generator power required.

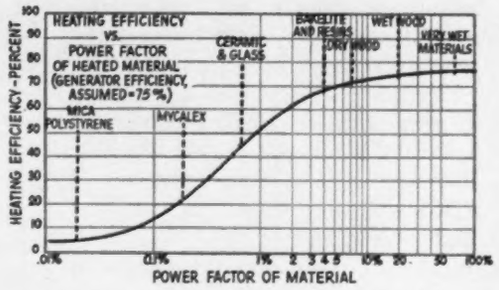
The cost per 1000 B.T.U. may be as low as 1 cent, including tube replacement.

**What Equipment Is Required?** The only equipment needed for electronic heating is an electronic generator (see photo) and its associated electrical leads and coupling unit (in some cases) for putting power into the load. The generator takes power from standard AC lines. The power factor of the generator is about 85%.

**Is Equipment Available?** Standard RCA electronic generators can be obtained on priority in ratings up to 100 kilowatts output. (See coupon.)

**Installation and Service.** RCA engineers supervise installation; the RCA Service Company—specialists in electronic equipment servicing—will keep your equipment in tip-top condition on a yearly maintenance contract basis.

**How About Your Application?** RCA electronic application engineers will be glad to help you apply electronic heat to your manufacturing processes. Write, stating kind of material, shape, size, amount to be heated per hour, and other pertinent details. Address: RCA, Dept. 70-43F, Camden, New Jersey. Or send the coupon for further information.




● *Assuming a 75% efficiency for the electronic generator, the overall efficiency of an electronic heating installation depends on power factor of the heated material, as shown.*

**FREE!**

*(Please check items wanted)*

☐ Bulletin "RCA Electronic Power Generator Model 2B"—2 kilowatts output.

☐ Bulletin "RCA Electronic Power Generator Model 15B"—15 kilowatts output.

☐ "Molding with Radio-Frequency"—a 4-page article on electronic heat for plastics molding.

☐ "Heating Wood with Radio-frequency Power"—a 12-page article from "Transactions of A.S.M.E.

RCA, Dept. 70-43F, Camden, N. J.

Gentlemen:

Please send me the items checked above.

Name_____

Company_____

Address_____

City_____ State_____

RCA

RCA ELECTRONIC HEAT

RADIO CORPORATION OF AMERICA

# New 5,000-Kva. Core Fits 3,000-Kva. Tank

By J. J. SAMSON
Supervising Engineer Equipment Section, Commonwealth Edison Company, Chicago

An odd combination of circumstances plus the advances of two decades in transformer design combined recently to allow the use of the core and coil assemblies of five uncompleted 5,000-kva. units in old 3,000-kva. transformer tanks on the system of the Commonwealth Edison Company. The change made it possible for the Chicago company to junk the old cores and coils and still release practically as much scrap metal for war purposes as though the new 5,000's had been junked.

The swap had several advantages. It provided needed extra capacity at system substations. It secured this increase with an actual reduction of 1,355 watts per transformer in core and copper losses. And, finally, it saved for the company the expense of paying cancellation charges on an order for these 12,000/2,300-4,000-volt transformers which were practically completed when war cut off the supply of steel and forced the company to drop a projected rehabilitation program.

With the advent of the WPB-sponsored industrial salvage campaign, a survey of old transformers on the Chicago system revealed the possibility of making the switch just described. Weights were similar, transformer tank space and cooling capacity were adequate and losses were lower. The proposal was therefore made to WPB that instead of junking the partially completed 5,000-kva. transformers lying in the manufacturer's plant it be permitted to junk the 20-year-old 3,000-kva. core and coil instead, since they had within 7,100 lb. the same weight of core steel and within 600 lb. the same amount of copper. This proposal was accepted by WPB authorities.

Since the five old 3,000-kva. transformers included one spare, it was possible to ship one transformer at a time to the manufacturer's plant to make the transfer, without interrupting service in any way. The transfer was effected in this manner without difficulty.

The accompanying table shows a comparison of the ratings, losses, weights and dimensions of the modern 5,000-kva. and the 3,000-kva. design of two decades ago.

**Two Decades of Design Progress Show in This Transformer Comparison**

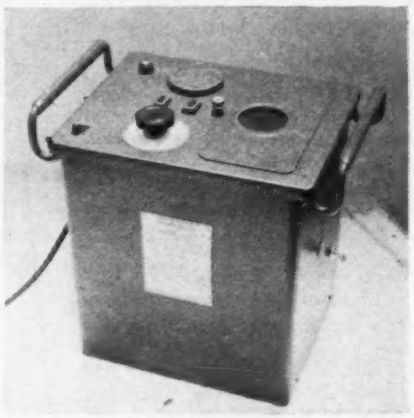
| | Old Design 3,000 Kva. | Modern Design 5,000 Kva. |
|---|---|---|
| Core loss watts (guarantee) | 14,000 | 11,800 |
| Core and copper loss watts (guarantee) | 55,800 | 41,000 |
| Core loss watts (test) | 12,800 | 9,000 |
| Core and copper loss watts (test) | 40,855 | 39,500 |
| Weights | | |
| Core steel, lb. | 12,400 | 19,500 |
| Copper, lb. | 2,400 | 3,000 |
| Case and fittings, lb. | 9,800 | 8,000 |
| Dimensions | | |
| Tank, opening, in. | 47 x 95 | 41½ x 86 |
| Height, in. | 138 | 120 |

•

# Oil Tester Features Portability, Safety

By L. H. NEWELL,
Transformer Application Engineer, Westinghouse Electric & Manufacturing Company, Sharon, Pa.

For measuring the insulation strength of oil or Askarel, used in transformers or circuit breakers, a portable testing set rated ½ kva., 35,000 volts maximum for operation on 120-volt, 50-60 cycle, single-phase supply has been developed by Westinghouse engineers. This set combines in a compact light-weight unit a step-up transformer, variable autotransformer, voltmeter, standard oil test cup and control equipment. Because of its light-weight, compact design, this set is particularly applicable to field testing at outlying substations and is equally suitable for laboratory testing of oil.



**PORTABLE oil tester features smooth voltage control, simplicity and safety of operation; front end of control panel is at left side of illustration**

All live parts including the oil test cup are fully inclosed during tests. The light-weight steel case is grounded through a third conductor in the supply cable, which terminates in the ground terminal of a three-wire polarized plug.

The high-voltage winding of the dry type testing transformer has the mid-point grounded. The two high-voltage end leads of this winding are brought into the oil cup compartment through two oil-tight H. V. bushings, which support the oil test cup. A voltmeter coil is so located with respect to the H. V. winding in this testing transformer that its ratio is practically constant for all voltages.

The circuit supplying the L.V. winding of the testing transformer consists of a line breaker with thermal overload protection and a contactor controlled by a normally open, momentary-contact push button, and an instantaneous trip overload relay. The control is so arranged that the push button must be depressed during a test to maintain voltage at the terminals of the test cup.

### *Over-Current Relay*

The applied voltage may be uniformly and continuously raised from zero to 35,000 volts by means of a variable auto-transformer. A control knob with calibrated scale for indicating approximate test voltages is conveniently located at the right of the control panel. A flush-mounted voltmeter with protecting cover indicates accurately the voltage applied to the oil sample in the test cup. When the test sample breaks down the over-current relay automatically trips the contactor, preventing continuation of the arc and burning of the electrodes. The over-current relay remains tripped until it is reset by releasing the push button.

The special Moldarta oil test cup is mounted between clips on the H.V. bushing in the cup compartment and may easily be removed for cleaning or refilling by opening the compartment cover and lifting the cup out. This cup compartment is located in the rear of the control panel and has a hinged metal cover fitted with a glass window so that the operator can observe the break-down of the oil test sample. When the compartment cover is in the closed position, a normally open door switch closes the control circuit. Until the control circuit is closed, voltage cannot be applied to the test transformer.

# Don't make Sensitive Circuits Fight Corrosion too!

Dielectrics for precise electrical instruments must have more than good electric properties—their chemical composition has to be such that they do not promote electro chemical corrosion. Lumarith, cellulose acetate plastic, does not form decomposition products harmful to copper when in contact with current carrying wires and moisture. In film and foil form, it is used as a protective lining for coils, tubes, bobbins and spools. Lumarith, too, can be molded into these and other electrical shapes—in any color, opaque or transparent. Lumarith is tough, resistant to solvents, chip-proof and lightweight.

Write for Celanese Celluloid Corporation's electrical booklet. It will supply you with pertinent facts regarding Lumarith's electrical advantages. Complete data on dielectric strength, resistivity, etc. are included. Celanese Celluloid Corporation, *The First Name in Plastics*, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16. Representatives: Dayton, Philadelphia, Cleveland, Chicago, St. Louis, Detroit, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto.

***Lumarith Plastics in Film . . . Foil . . . Molding Materials and Other Forms***

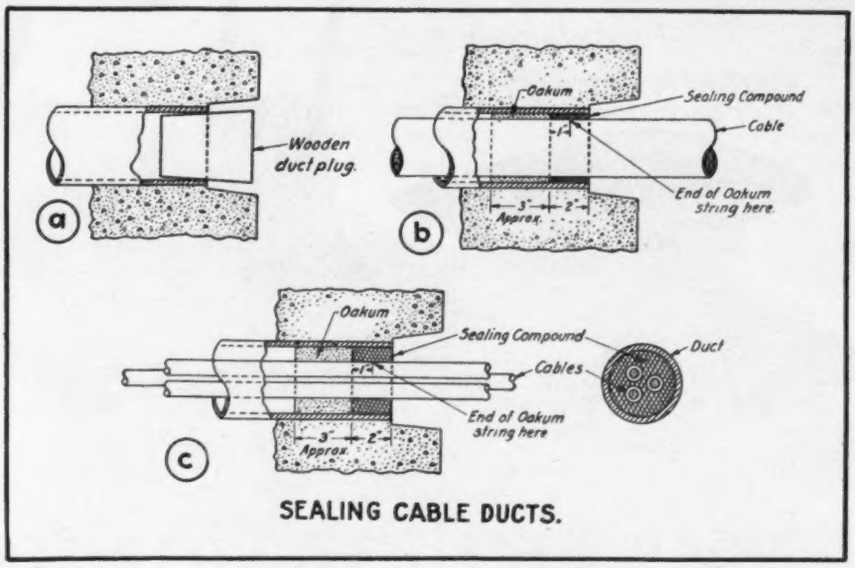
**Lumarith*** 

A CELANESE* PLASTIC

*Reg. U. S. Pat. Off.

# A GUIDE FOR SEALING CABLE DUCTS

**Outlined procedure has been adapted from a book of standardized practices of the Boston Edison Company**




SEALING CABLE DUCTS.

**SEALING (a) an empty cable duct, (b) a duct occupied by one cable, (c) a duct occupied by two or more cables**

All ducts, whether empty or occupied, which lead to stations, vaults or buildings, should be sealed at both ends to exclude smoke, gas or water from the station, vault or building to or from which they go. Ducts which lead to fire alarm pedestals or boxes should be sealed at the manhole end.

### *A. Sealing Empty Ducts*

1. Duct plugs of specified length and taper, made of either wood or fiber, are approved for this use.

2. When sealing an empty duct, the inside of the duct must first be cleaned thoroughly and wiped dry.

3. Place a duct plug of the proper size in the duct mouth and drive it into the duct to a snug fit as shown in (a). Do not attempt to use cracked or broken plugs. Do not drive the duct plug into the duct so hard that the duct will be split.

### *B. Sealing Ducts Occupied by One Cable*

1. Oakum and elastic sealing compound are approved for this use. The sealing compound must be of putty-like consistency, soft enough to handle easily with hands or trowel, but not so soft as to run. It must not harden materially when exposed to the air.

2. When sealing a duct occupied by one cable, the cable should first be centered in the duct, if possible, and the inside of the duct cleaned and wiped dry. This is necessary to insure that the sealing compound will adhere.

3. Roll some oakum between the hands to form a soft string of suitable thickness, then wind the oakum string around the cable and pack it into a solid mass around the cable for a depth of approximately 3 in. Pack the oakum into the duct so as to leave 2 in. for the sealing compound. The end of the oakum string should terminate on the upper side of the cable and should be brought out at a point approximately 1 in. from the finished face of the sealing compound.

4. Remainder of the duct should now be filled with sealing compound, leaving a smooth finish flush with the edge of the duct. A trowel, first wet with kerosene to prevent sticking of the sealing compound, should be used for this purpose. To insure a perfect seal and one that is watertight, the sealing compound should be forced against the sides of the duct while it is being packed in place. A cross-section of a sealed duct is shown in (b).

5. When a cable is protected with a fairleader, usually no oakum or sealing compound can be inserted because of lack of space. In this case the fire-felt protection on the cable should be brought hard up against the fairleader. In cases where space permits, sealing compound should be pressed in between the fairleader and the duct.

### *C. Sealing Ducts Occupied by More than One Cable*

1. When a duct is occupied by a number of small cables, they should be separated and sealing compound put between them.

2. The cable should then be brought together and treated as one large cable, proceeding as outlined under "B." A cross-section of a sealed duct is shown in (c).

### *D. Removing the Seal From an Occupied Duct*

1. When it is necessary to remove the oakum and sealing compound from a duct, the sealing compound on the upper side of the cable should be removed until the oakum is found.

2. Pull out the oakum, thus loosening most of the sealing compound. The remaining sealing compound can then be easily removed with a small screwdriver.

3. Sealing compound should not become hard or brittle. When removed from the duct, it should be saved for future use. Approved compounds are not injurious to the hands and can be washed off with kerosene.

# Highlights of Anaconda messages to the public

## re: POSTWAR ELECTRICAL POSSIBILITIES

### TIME

..."America's electrical future is limitless... with victory, expanded use of electric energy will affect everyone—industrialist, dealer, housewife—employment, prosperity, living."

### BUSINESS WEEK

..."but this fact is all important: when you plan your electrical future, start with *wiring. Adequate* wiring will be essential to full utilization of tomorrow's electrical possibilities . . . and that applies to municipality or factory, business or home . . ."

### NEWSWEEK

..."by all means, bring the power engineer from your local utility and your electrical contractor into your *advance* planning. *Unwired* planning will cost you a lot more than *planned* wiring!"

Anaconda Wire & Cable Company is devoting its current advertising to spreading public knowledge and appreciation of what the electrical industry means to the country and to postwar prosperity.

Obviously, adequate wiring will be essential. The wider the recognition of this, the better business for everyone... utility, contractor, wholesaler, manufacturer.

And now is the time to lay the foundation for tomorrow's electrical needs. More and better wiring should be a part of every postwar plan.

44220

ANACONDA

**ANACONDA WIRE & CABLE COMPANY**

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

*Electrical Wires and Cables of Copper are the Life Lines of our Nation*

## Lineman's "Shorthand"—Abbreviations used by New England Power System to Save Time in the Making of Field Notes

### For Pole Inspection

| | |
|---|---|
| A | —Anchor |
| AG | —Anchor and guy |
| Attch | —Attachment |
| Av | —Avenue |
| B | —Backward or back |
| Bk | —Broken |
| Bkt | —Bracket |
| Ca | —Cable |
| Ckt | —Circuit |
| Cl | —Clearance |
| Cor | —Corner |
| Crk | —Cracked |
| Xg | —Crossing |
| Xm | —Crossarm |
| Co | —Cutout |
| Da | —Double arm |
| DBA | —Double buck arm |
| Dvwy | —Driveway |
| AA | —Extension arm |
| Fx | —Fixture |
| FA | —Fire alarm |
| G | —Guy |
| GL | —Ground line |
| Hgt | —Height |
| HT | —High Tension |
| H Ht | —Hollow heart |
| Jct | —Junction |
| LA | —Lighting arrester |
| LT | —Low tension |
| Lgt | —Light |
| Mv | —Move |
| Out | —Outrigger arm |
| PB | —Push brace |
| Pkt | —Decay pocket |
| P | —Pole |
| Pr | —Pair |
| Pri | —Primary |
| PS | —Police Signal |
| PT | —Postal Telegraph |
| Pv | —Private |
| Rf | —Reinforce |
| Rt | —Right |
| Rd | —Road |
| RGB | —Rock Guy Bolt |
| Rm | —Remove |
| Rpl | —Replace |
| RR | —Railroad |
| R/W | —Right-of-way |
| S | —Stub |
| St | —Street |
| W | —Wire |
| S | —Service |
| Sec | —Secondary |
| Sd | —Side |
| S-G | —Stub and guy |
| Sth | —Straighten |
| Std | —Standard |
| Tf | —Transformer |
| Trsf | —Transfer |
| T=W | —Re-tie loose wires |
| TG | —Tree guy |
| Tel | —Telephone |
| Tm | —Trim |
| US | —Undersize |
| UG | —Underground |
| W | —Wire |
| WPH | —Woodpecker holes |
| WU | —Western Union |

### For Inspection and Replacement Reports

Treatment

| | |
|---|---|
| Bt | —Butt treated |
| C | —Full length treated, creosote |
| ZA | —Full length treated, ZMA |
| Mon | —Full length treated, Montan wax creosote |
| GS | —Full length treated, green salt |
| IBt | —Incised—Butt treated |
| U | —Untreated |

In case of doubt or indefinite records, omit treatment abbreviation

Species of Wood

| | |
|---|---|
| Ch | —Chestnut |
| RC | —Western red cedar |
| NC | —Northern or native cedar, sometimes called Eastern or white |
| SP | —Southern pine |
| NP | —Norway pine |
| Cy | —Cypress |
| Loc | —Locust |
| Hem | —Hemlock |

When using abbreviations place treatment first followed by specie, thus—Btch = Butt treated Chestnut.

# Mixed Voltage Ratings in Capacitor Bank

By V. R. PARRACK
Virginia Public Service Company, Charlottesville, Va.

Opportunity to observe the behavior of shunt capacitors in rather unusual arrangement is afforded by an installation recently completed on the system of the Virginia Public Service Company. In total, 900 15-kva. capacitors are used. They are installed at a substation in five adjacently placed banks of 2,700 kva. each, thus allowing reactive capacity to be added and subtracted in five equal steps up to 13,500 kva.

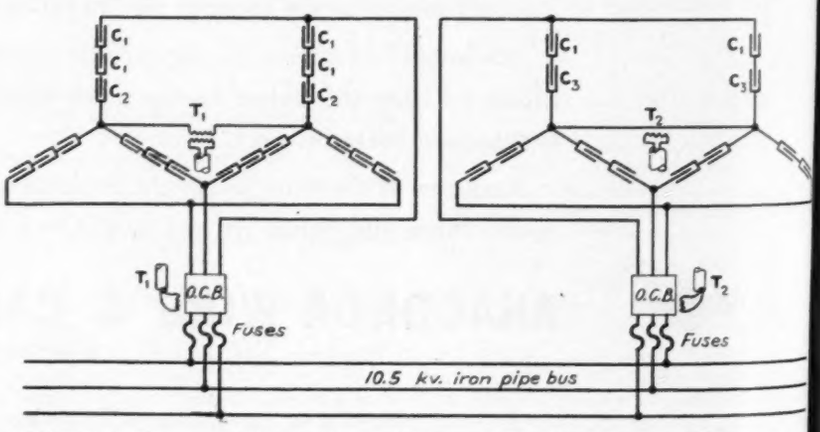
All five banks are Y-connected to the 10.5-kv. substation bus extension of slotted iron pipe. Each bank consists, as is shown in the diagrams, of a double Y with individual capacitors connected in series-parallel combinations to match the 6 kv. to neutral and to provide the proper amperage capacity. In three of the banks the units are connected as indicated at the right of the diagram and in the two other banks as at the left of the diagram. The nominal current per leg of each Y is thus 75 amps.

As in similar installations on other systems it was the idea here that the individual capacitors might some day be available for general distribution system use. Single-phase primaries of 2,300 volts are usual on the Virginia Public Service system, but there is also some 3,450-volt distribution. This is the reason a certain number of 3.6-kv. capacitors were included in the bank installation. Because of the 6 kv. to neutral it was impossible to use 2.4-kv. units throughout unless operation at considerably under unit rating were accepted. And that, of course, would require a larger number of units to supply the required capacity and would cost more money.

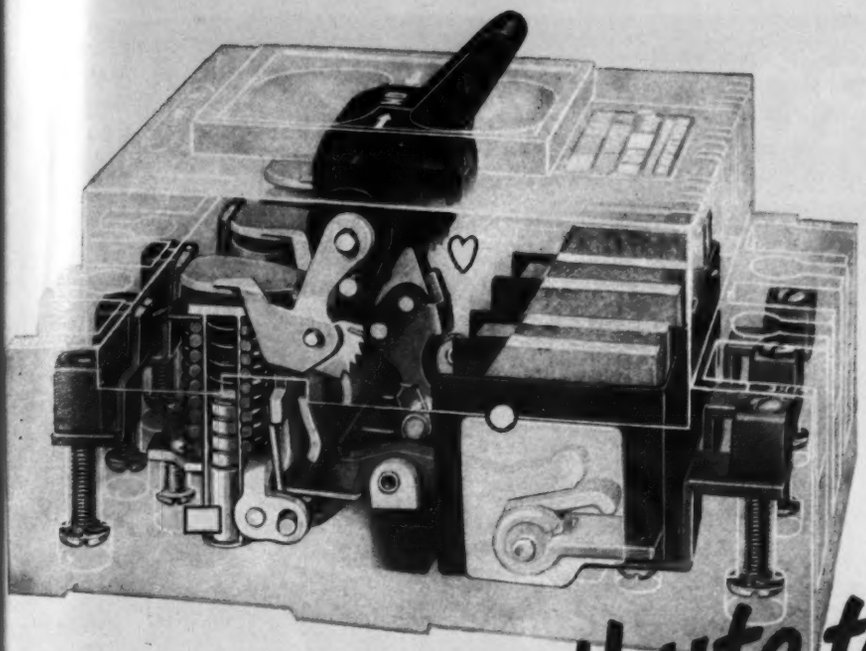
Each of the five double-Y banks is switched by a 50,000-kva. oil circuit breaker. In relation to the short-circuit capacity of the system at the point where the capacitors are installed, these breakers are too small. But breakers of adequate interrupting capacity would have added greatly to the cost of the installation. It was anticipated that most troubles that might occur in the capacitor banks would fall far below short circuit in current magnitude and that a 50,000-kva. breaker would be amply able to handle them. And to protect against the remote possibility of dead short circuit a set of fuses was installed ahead of each circuit breaker.

In addition to its features of convenience and flexibility in grouping the units of a bank, the double-Y layout also provided a protection means. The neutrals of the two Y's are not grounded, but float free. In the case of the 2.4- and 3.6-kv. unit combination the neutrals are tied together through a current transformer. In the other case a potential transformer is used. In each, any trouble in either Y will cause a displacement between the neutrals, thus energizing the trip coil and opening the breaker.

Each of the five capacitor banks is contained in a separate bay and there is a space between the old substation structure and the first capacitor bay. The iron pipe bus spanning this space has no connections on it and is clamped only at the ends. From this section of the bus there comes



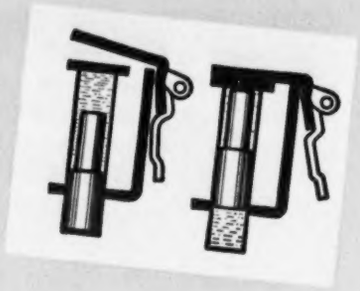

**ARRANGEMENT of capacitors in Y connection to 10.5-kv. bus**
$C_1$ = Twelve 2.4-kv. units in parallel. $C_2$ = Six 1.2-kv. units in parallel. $C_3$ = Eight 3.6-kv. units in parallel. $T_1$ = Trip coil operated by potential transformer. $T_2$ = Trip coil operated by current transformer.



# All 3 contribute to the High Efficiency of

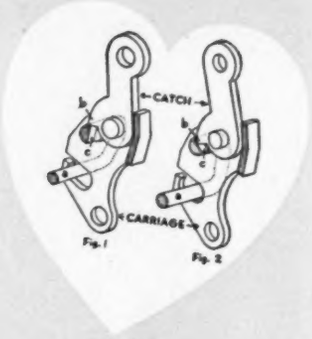
# HEINEMANN MAGNETIC CIRCUIT BREAKERS

They employ an overload trip unit that is FULLY ELECTRO-MAGNETIC and have definite and instantaneous trip points independent of their time delay characteristics. The current carrying capacity as well as the minimum and instantaneous trip points are not affected by ambient temperatures. A true inverse time delay in the hermetically sealed unit allows the passage of inrush current. However, continued overload opens the breaker in time inverse to the ratio of the current.



**TIME DELAY ON OVERLOADS**

The magnet coil surrounds a hermetically sealed liquid filled cylinder containing an iron plunger which while normally out of the magnetic field moves into it on overloads, the liquid controlling its speed. As the plunger rises to the top of the cylinder, the magnetic flux increases to its maximum. At this point the armature is attracted and operates the latch.




**HIGH SPEED LATCH**

The armature, on engaging the lower leg of the lock (a) rotates it so that the tooth of the catch (b) passes through the cut portion of the lock (c) and opens the contacts. Of all known latches this one acts with the least amount of friction and mechanical delay. The latch collapses only on short circuit or overload conditions even if the handle is purposely held in the "on" position.

**HIGH SPEED BLOWOUT**

The stationary contact is coiled around an insulated iron core connecting steel plates to form a U-shaped magnet. On overloads and short circuits, the current flowing through the contact creates magnetic lines which force the arc into the arcing chamber and blow it out. As the value of the current to be interrupted increases, the quenching effect becomes greater due to intensified magnetic field.

## HEINEMANN CIRCUIT BREAKER CO.

*Subsidiary of Heinemann Electric Co., Est. 1888*

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Ordinarily, high-purity graphite is made only by specialized chemical manufacturers, and is of interest only to chemists and metallurgical engineers. In this case, however, we believe Stackpole Spectrographite No. 1 will prove generally interesting to readers of this publication—not so much because you might use it, but because it offers a convincing illustration of the progressive engineering behind the many Stackpole molded carbon, graphite, and metal composition products you do use.

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# STACKPOLE

**EVERYTHING IN CARBON BUT DIAMONDS**

lainly audible tone when the capaci-
ors are energized. The sound changes
volume as changes are made in
he number of banks connected, loud-
st when all are on. It is supposed
hat the sound is caused by the slotted
ipe acting as a tuning fork in a sort
f magnetostriction phenomenon.

•

## Spray Cools Air for Network Vault

Special vault and transformer ooling facilities, akin to a rudimen-ary air-conditioning system, keeps he air inside the underground net-ork transformer vault serving one f the larger Louisville, Ky., hotels bout 20 deg. cooler than outside ir during severe summer spells. The ault houses three 500-kva., three-hase network transformers and is he largest installation on the under-round network of the Louisville Gas Electric Company in the downtown rea. Layout of the vault is shown, ith the general arrangement of the ooling system indicated.

Air from an alley, adjacent to the ault, is drawn at ground level hrough a grating-covered concrete uct that passes downward and hrough the vault wall into an excel-ior-filled spray chamber 4 ft. x ft. 6 in. x 2 in. thick. Water at 5 deg., from a tap in the hotel deep-ell line is sprayed over the excel-sior (a wartime substitute for steel wool) through a ½-in. pipe, drilled at intervals with fine holes. The spray pipe runs the top length of the spray chamber and is equipped with a manually adjusted regulating valve to control water flow. Discharge water from the chamber flows to an adjacent sewer in the hotel basement.

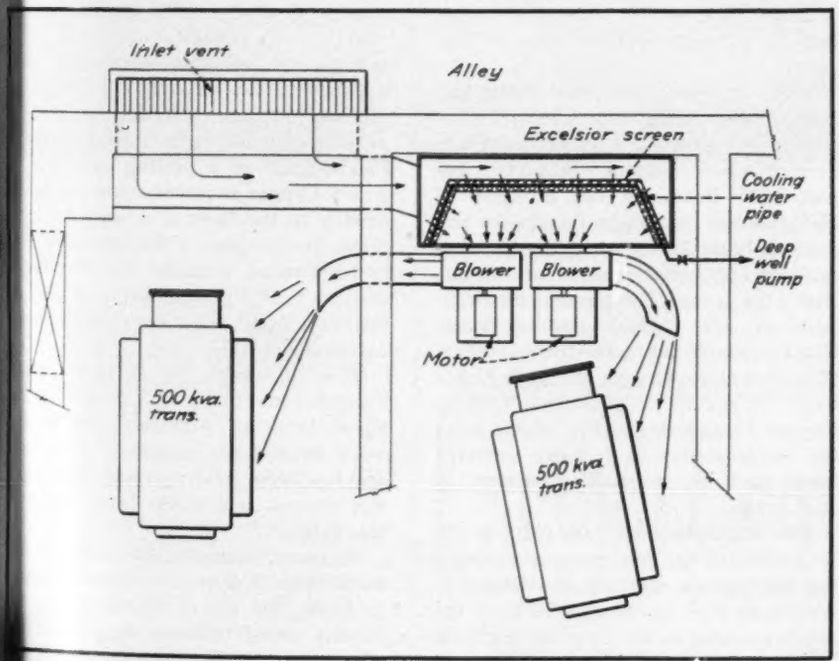
Air from the spray chamber discharges into an adjacent plenum chamber 4 ft. x 5 ft. x 1 ft. 6 in. thick from which two ducts lead to ¾-hp., three-phase fans which blow the cooled air directly against two of the three network transformers.

Several factors combine to make this cooling system effective. In addition to cooling the incoming air by direct contact with the 55 deg. water spray, heat (latent heat of vaporization) is also drawn from the air to vaporize the moisture entrained in the air passing through the spray chamber. This cooled air, impinging directly on the transformers from the fans, tends to break up any stagnant film of hot air on the transformer cooling surfaces. At present the air is discharged against only two of the three network transformers, the third is located in a separate compartment of the vault and is cooled by an auxiliary blower.

No exact record has been kept of the amount of water used by this cooling system per day; however, it is estimated that several hundred gallons are used in 24 hours. The cooling fans are operated 15-18 hours per day in hot summer weather, being cut off automatically at a predetermined hour by a time switch. Cooling water, however, is allowed to run through the spray chamber continuously.

Cost of operating the cooler is confined to the cost of the current consumed by the fans since the hotel makes no charge for the cooling water used.

It is of incidental interest that excelsior has proved an adequate wartime substitute for metal wool in the spray chamber. It has been necessary, however, to change the excelsior more frequently as might be expected. A new charge is required about every two months.




AYOUT of rudimentary air-conditioning system used in large Louisville network vault

•

## A. C. Arc Welder Demagnetizes Tools

Ingenuity has often led to the use of arc welders to solve problems other than in the fabrication of metals. Among these have been the use of d.c. equipments in thawing out pipes and in warming up airplane engines on cold mornings. A recent application is of a General Electric a.c. arc-welding transformer, equipped with stepless control, to demagnetize steel parts by a method similar to that employed by jewelers in demagnetizing watches, reports R. F. Wyer, General Electric welding engineer.

This method was used by E. L. Bailey, electrical engineer at the Chrysler tank plant in Detroit, to remedy trouble caused by metal parts clinging to dies which had become magnetized. Five or six turns of cable were wrapped around the die and a heavy 60-cycle alternating current from a 500-amp. a.c. welder was passed through the cable, the current then being gradually decreased by turning the current-control crank on the welder. This procedure is now regularly employed in the Chrysler plant.

The widely expanded use of highly hardenable alloy steels since the war began has brought to light numerous instances where permanent magnetism has caused trouble in arc welding, as well as in the operation of tools.

# Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 2


# "Phosphorized Admiralty"—and its dezincification-resistance

**The qualities of this condenser tube material as confirmed in actual performance and reported by Scovill engineers**

Millions of pounds of Phosphorized Admiralty are now in use in heat exchanger and condenser service — some since 1939 when this Scovill material was first introduced. Phosphorized Admiralty has built up a remarkable performance record and its resistance to dezincification is of a high order.

An explanation of this may be of interest.

The *dezincification-resistance* of Phosphorous bearing brasses is well known.

The *marked influence* of a very small percentage of Phosphorous in controlling this form of corrosion of Brass has been the subject of considerable research. In this connection, much interest has been shown not only in the actual ability of Phosphorized Admiralty and other phosphorized brasses to inhibit dezincification but in the reasons for the beneficial effect imparted to such alloys by Phosphorous.

Several theories have been advanced and much investigational work has been carried out to explain the inhibiting action of Phosphorous in brasses under service conditions which would normally result in dezincification of the metal. This problem will be better understood by a consideration of the properties of Phosphorous and its compounds.

Phosphorous is non-metallic in character and enters into combination with Oxygen to form a series of oxides. From Phosphorous and its various oxides, a number of metal salts may be obtained. With the exception of Sodium and Potassium salts, these metal compounds are, in general, insoluble in water. In some cases, these salts exhibit colloidal properties to some degree. The end product of the oxidation of Phosphorous gives ortho-phosphates and, in the presence of sufficient Oxygen, ortho-phosphates will be found.

One interesting detail in connection with the compounds of Phosphorous is the behavior of Tin and Phosphorous when they are present in the same solution. Tin Oxide in colloidal solution readily takes up or absorbs Phosphates and this reaction usually hastens the precipitation of Tin in a very insoluble form. It was earlier believed that this reaction was entirely of a colloidal nature, but, recently, it has been shown that a definite compound of Tin Phosphate is formed, at least in certain conditions. This particular reaction between Tin and Phosphorous compounds is stressed because it has been noted in a research on the dezincification of brasses that the presence of Tin in itself retards dezincification to some extent; but the addition of Phosphorous (as in Phosphorized Admiralty metal) is necessary to prevent dezincification of the alloy.

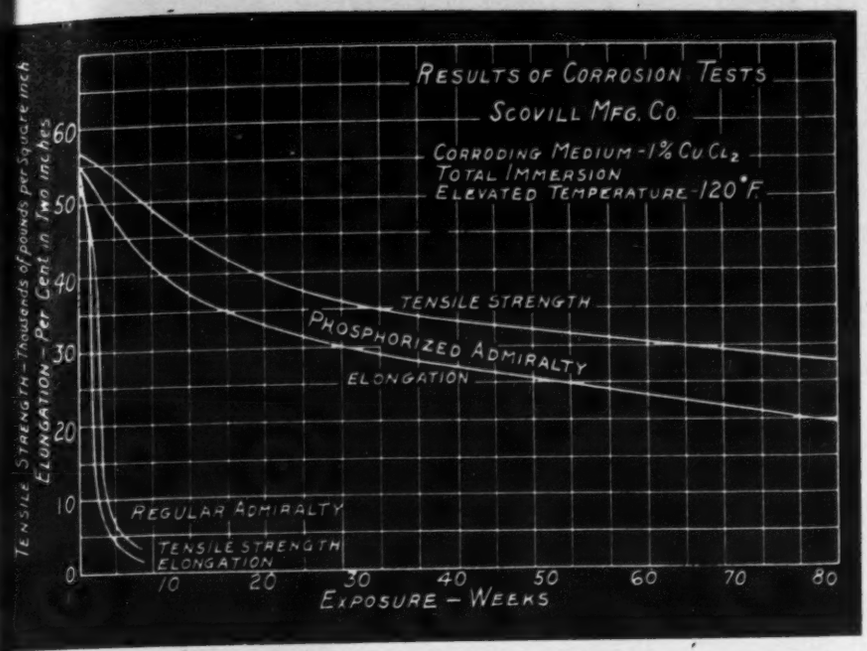
If the foregoing discussion of the formation of insoluble and colloidal metal salts of Phosphorous is remembered, the dezincification-resistant property imparted to Brass by the addition of Phosphorous can more readily be explained. In services where dezincification of Admiralty metal or other brasses has been experienced, the phosphorous content of the dezincification-resistant alloys probably promotes the formation of a protective film (in the nature of a metal phosphate or phosphide such as Copper Phosphide $Cu_3P_2$), which coats the metal surface at initially corroded areas and arrests further action at such areas.

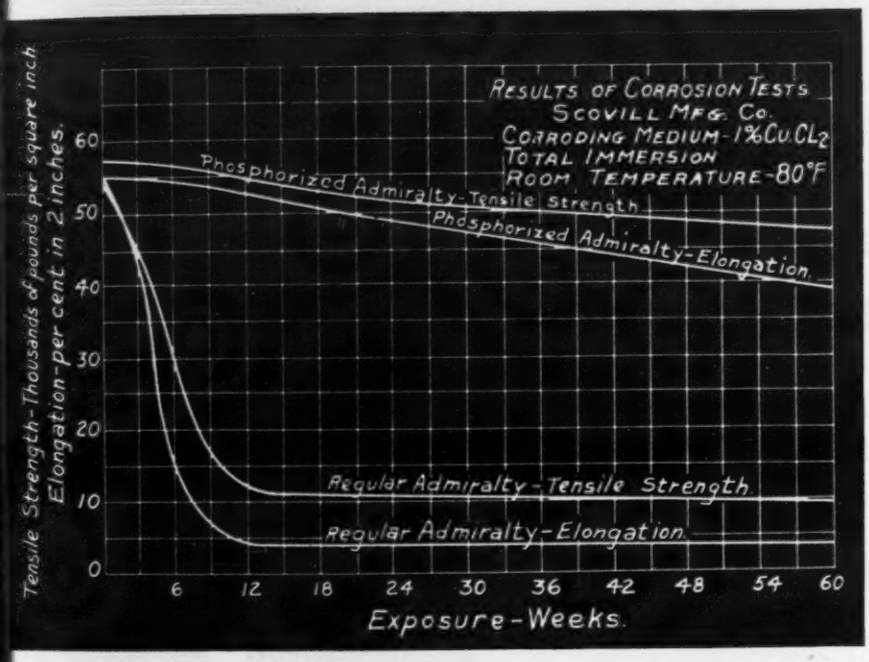
The reactions which take place in the formation of the phosphorous containing film may or may not be complex in nature, as may be anticipated from the above remarks on the chemical reactions of Phosphorous. Thus, in the early stages of corrosion, Phosphorous, together with Copper, Zinc and Tin may pass into solution and the Phosphorous may then combine with certain of the metal ions in solution to form an insoluble compound which coats the metal surface as a stable impervious film. The formation of this compound may involve nothing more than introduction of ions of the reacting elements into the solution, followed by precipitation and deposition of certain combinations of such ions on the metal surface.

It is probable, however, that a more complex series of reactions takes place and may be better explained by considering the existence of colloids in the medium in contact with the metal surface. In this connection, it may be pointed out that very minute quantities of colloids in a solution often times produce a profound change in the behavior of such solutions. In the plating of metals, for example, colloids in the plating bath may alter the type of plate, may prevent plating altogether, or may change the conditions (current density, voltage, etc.) at which satisfactory plating may be carried out. The subject of plating is introduced in this discussion of colloids because dezincification may be looked upon as a plating operation in which Copper is plated upon the brass, usually in the form of a porous, brittle mass. In the case of Phosphorized Admiralty tubes, colloidal Tin Phosphate or other metal phosphates may play an important part in preventing dezincification of the alloy.

This discussion of the part which Phosphorous plays in preventing dezincification of Admiralty metal and other Brasses has necessarily been brief and has been presented only because of the interest which has been shown in this subject.

Wherever dezincification of Admiralty metal tubes has been a serious corrosion problem, the use of Phosphorized Admiralty metal tubes is suggested. This alloy combines the general excellent corrosion-resistant properties of Admiralty metal, a desirable fine grain structure of




developed primarily for oil refineries and gasoline plants because in those places the phenomenon of dezincification is pronounced and widespread, it is equally applicable to any situation where dezincification of Admiralty is a problem — particularly at elevated temperatures.

"Phosphorized Admiralty tubes" for condenser and heat exchanger service are covered by patent 2,224,095 and can be legally supplied only by the owner of this Scovill Manufacturing Company patent, or one of its licensees.

### Scovill Offers 3 Services to Tube Users

1. Information, like that appearing on these pages, which will help keep engineers informed of recent developments and recent thinking in the matter of condenser tubes. The new "Condenser Tube Booklet" — a part of Scovill's *Service in Manuals* is available, free, from Scovill Manufacturing Company, 24 Mill Street, Waterbury 91, Connecticut.

2. Research in Metals is another Scovill service, intended to establish new knowledge about metal alloys which will help develop better performance on the part of Scovill condenser tubes. Scovill *Service in Metals* also includes the testing of raw materials, the testing of finished tubes before shipment and the analysis of problems arising from tubes in service.

3. Individual recommendations for each customer's requirements constitute the third Scovill service. *Service in Men* brings you a wealth of experience to help you obtain the best results and to eliminate trouble causes.

the finished tubes, favorable physical properties and a very definite improvement over Admiralty metal in its very marked resistance to dezincification.

While Phosphorized Admiralty was

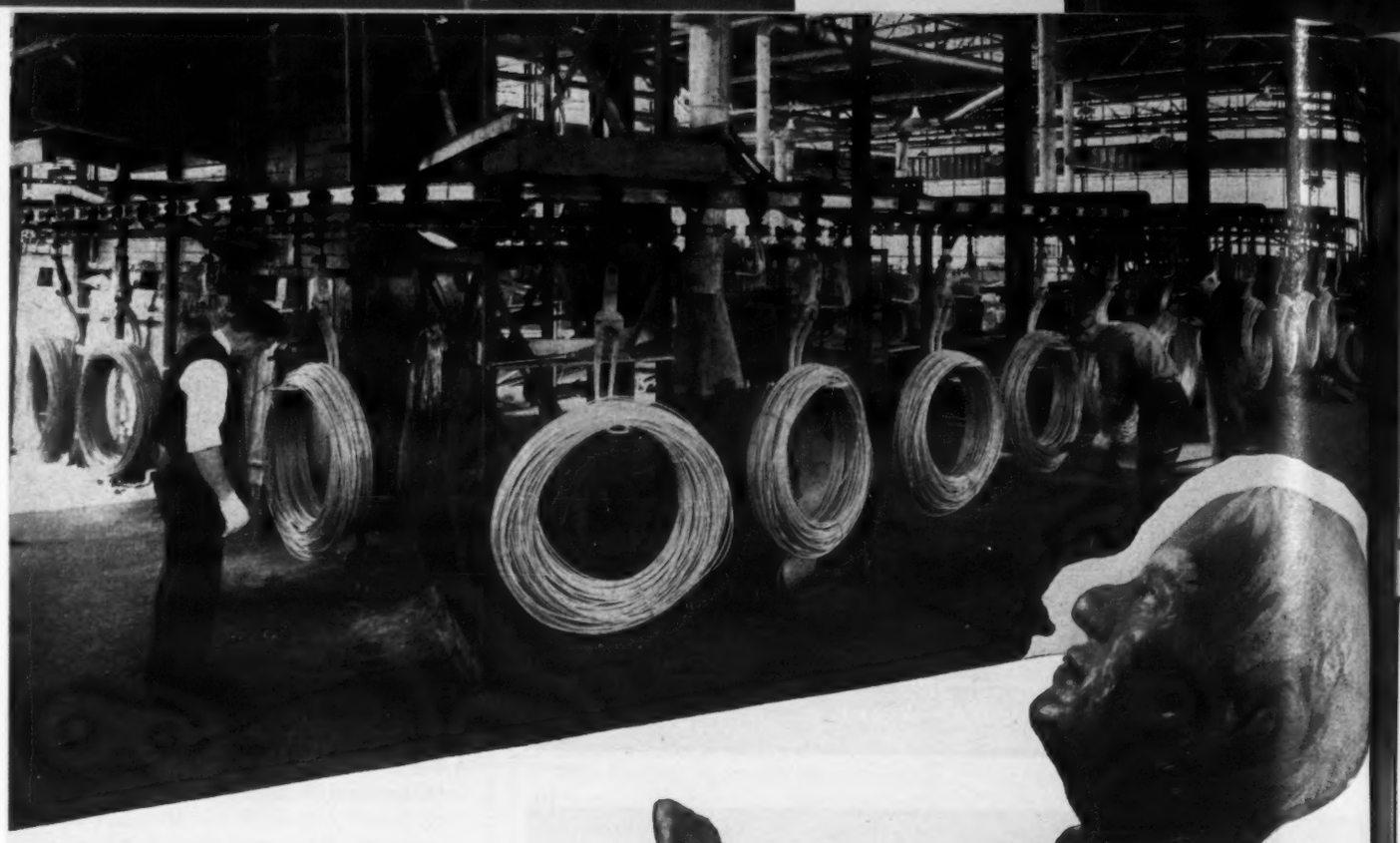
Limitation order L-154 issued by the OPM, limits the use of nonferrous condenser tubes in land power stations to Muntz metal for fresh water plants, and Admiralty metal for salt water plants. No nonferrous metals containing more copper and more tin than these two are permitted by the order.

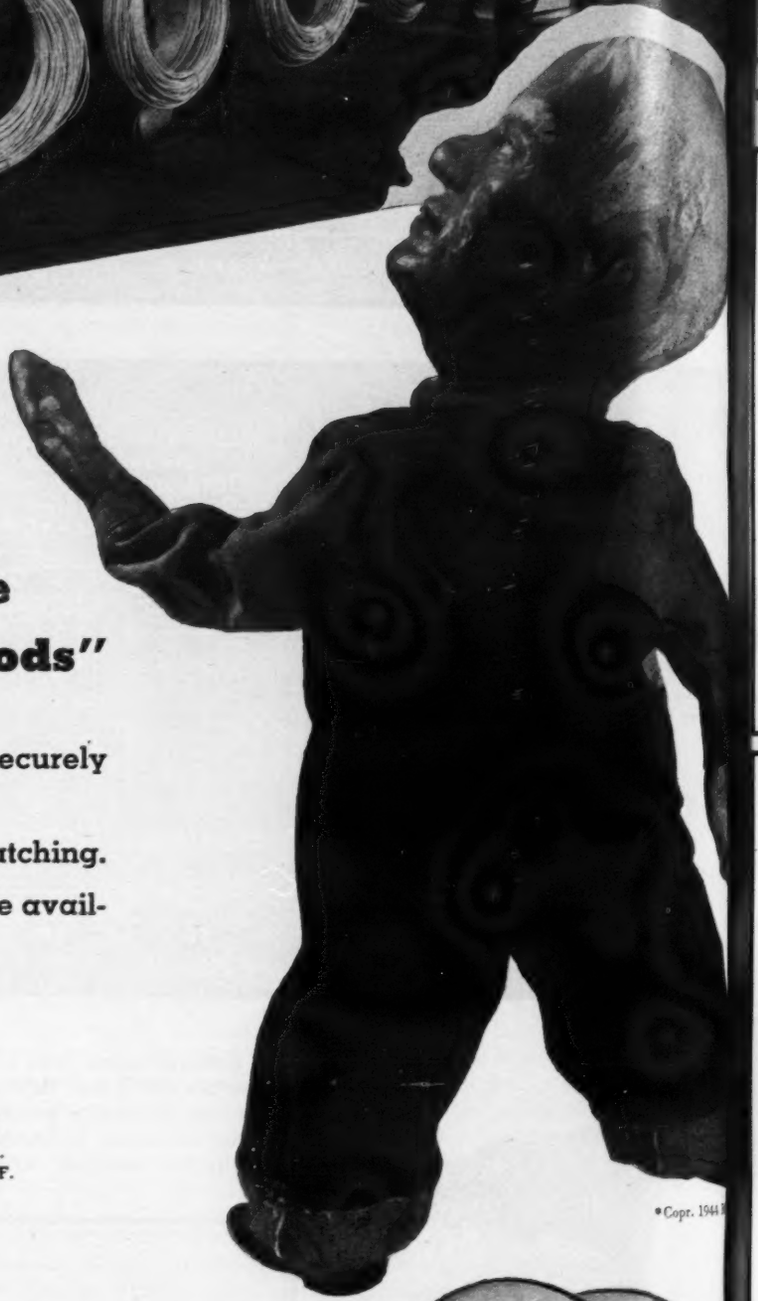
Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men





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## HOW TO DETERMINE

# SIZE OF SECONDARY CONDUCTOR TO PREVENT LAMP FLICKER[1]

By S. LUBIN[2] and F. B. SCOTT,[3] Engineer, REA Technical Standards Division

A procedure for the solution of the flicker problem was outlined in the first of this series of reference sheets. Accompanying charts are used (1) to determine the allowable percent of voltage fluctuation and (2) to convert that value to allowable percent of transformer and secondary impedance drop.

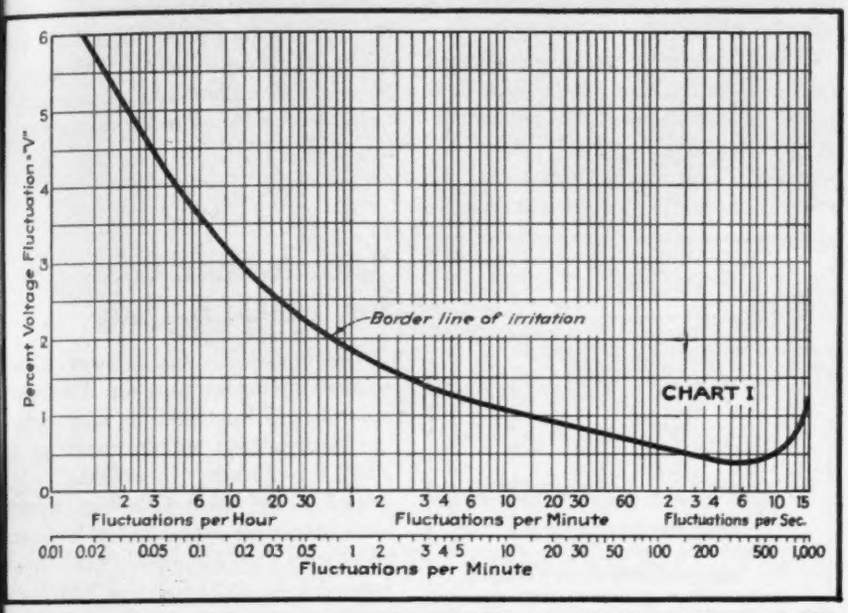



Chart I shows the permissible percent of voltage fluctuation for a varying number of fluctuations (or motor starts) per unit time. (Chart reproduced from ELECTRICAL WORLD, January 25, 1941, page 35.)

*Example*—A three-phase, 7½-hp., 220-volt motor starts six times per hour.

Against six fluctuations per hour on the curve read 3.6 percent allowable voltage fluctuation, V.

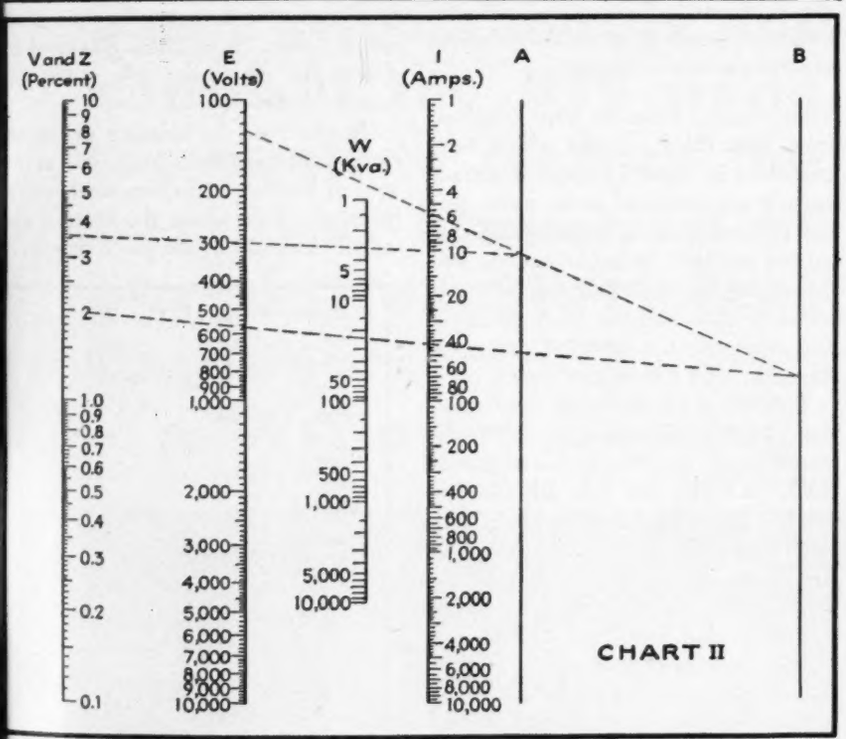



Chart II is used for converting allowable percent voltage fluctuation to allowable percent of transformer and secondary impedance drop.

Equation of chart: $Z = 1{,}000\ WV/IE$, where

$Z$ = Allowable percent of transformer and secondary impedance drop.

$W$ = Transformer kva. per phase.

$V$ = Allowable percent voltage fluctuation.

$I$ = Starting current.

$E$ = Rated secondary voltage, phase to neutral.

Instructions for use of chart:

1. Use value of V obtained from Chart I.
2. Connect V and W. Mark intersection on A.
3. Proceed from A to E. Mark intersection on B.
4. Connect B and I. Intersection on Z is allowable percent voltage fluctuation under actual bad conditions.

*Example*—Three 3-kva. Kuhlman transformers are used to serve the motor in the previous example. The starting current (from Table I) is 120 amp. Assume that the starter used limits the starting current to 35 percent of this value. Then, I = 42 amp.

1. From Chart I value of V = 3.6 percent.
2. Connect V = 3.6 percent with W = 3 kva. per phase. Mark intersection on A.
3. Proceed from A to E = 220/1.73 = 127 volts phase to neutral. Mark intersection on B.
4. Connect B and I = 42 amp. Then Z = 2 percent.

[1] Second of three reference sheets; series began in "Electrical World," Feb. 5, 1943, page 81.
[2] Engineer, on leave of absence.
[3] Senior Engineer.

# How to Test Insulating Materials *

### 6—Influence of Water

By A. E. PARKINSON
Continental-Diamond Fibre Co.,
Newark, Del.

Water being a better conductor than dry air and most insulating materials, the natural consequence is that the more water that is present in or around a dielectric the greater the effect (adverse) on the electrical properties.

Insulating materials, such as the type being considered here, differ greatly among themselves in resistance to water, whether in liquid form or as moisture vapor. Laminated phenolic plastics and similar products have excellent water resistance, although the several grades differ to some extent. Vulcanized fiber, on the other hand, has a relatively poor water resistance. Other materials, such as resin-impregnated vulcanized fiber, have water resistance or a water absorption value between the foregoing mentioned degrees.

The influence of water is indicated in the graphs where several electrical properties are plotted against the corresponding moisture content of the material. The curves (Fig. 1) for dielectric strength of a laminated phenolic plastic, Dilecto, were obtained from $\frac{1}{8}$-in. thick samples which were immersed in water for various periods up to a maximum of seven days. For the various grades selected XX absorbed the least moisture and showed the smallest drop in dielectric strength, while X absorbed the most moisture and showed the greatest drop in strength, with LE a little better.

The effect of moisture content on the dielectric constant and on the power factor and loss factor of grades XXX, XXXP and LE Dilecto immersed in water for periods up to a maximum of one week is shown in Fig. 2 and Fig. 3. Samples of the same grades placed in an atmosphere of 90 percent relative humidity for similar periods give very similar curves. In each case grade LE absorbed the most moisture and showed a much greater deterioration in properties than the two other grades.

The effect of direct water immersion on the insulation resistance, while similar to that experienced at high humidities, is neither identical nor necessarily even relative. This condition is best explained by some specific examples, as listed in an accompanying table.

**Insulation Resistance, Megohms**

| Material | Dry | Exposure* | | | Immersion† | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 4 | 7 | 1 | 4 | 7 |
| Dilecto, XXX | 750,000 | 2,300 | 670 | 480 | 67,600 | 3,400 | 1,150 |
| LE | 340,000 | 2,000 | 100 | 65 | 54,300 | 1,450 | 440 |
| Vulcoid | 234,000 | 120 | 25 | 20 | 7 | 0.65 | 0.50 |
| Diamond Vulcanized Fiber | 185,000 | 30 | 8 | 5 | 0.15 | 0.04 | 0.03 |

* Days at 90 percent relative humidity and 95 deg. F.
† Days in water at 75 deg. F.

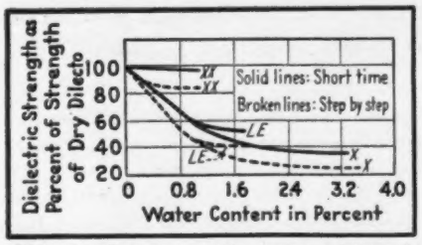



FIG. 1—Variation with water content in dielectric strength of various grades of Dilecto

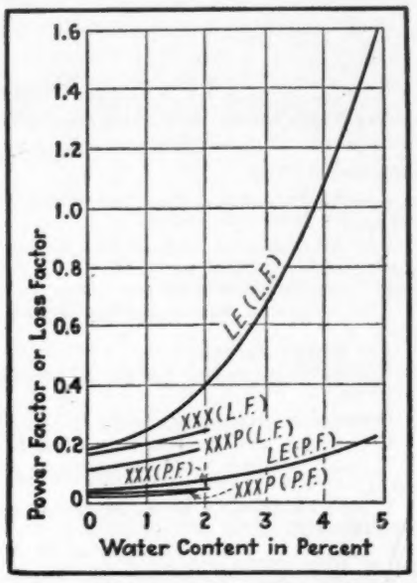



FIG. 2—Variations with water content in power factor and loss factor at $10^6$ cycles per second of various grades of Dilecto

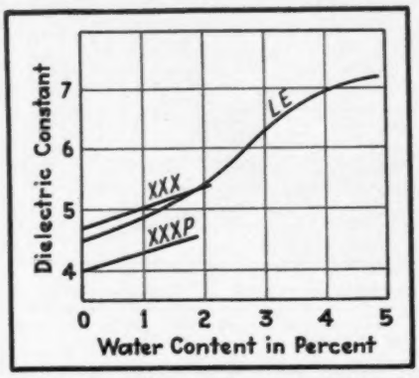


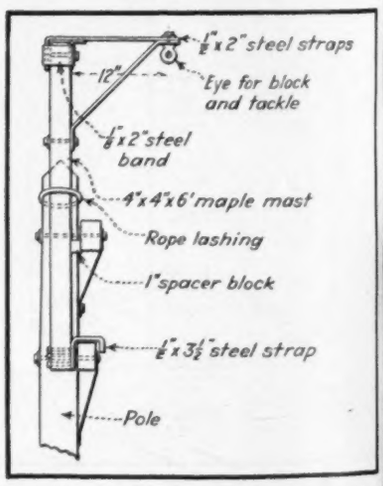

FIG 3—Variations with water content in dielectric constant at $10^6$ cycles per second of various grades of Dilecto

## Transformer Gin for 1,200-Lb. Lifts

Wisconsin Electric Power Company, Milwaukee, uses the illustrated pole top gin for installing and replacing distribution transformers up to 1,200 lb. (25 kva.) in weight.

The gin consists of a 4-in. square hard maple upright fitted at its lower end with an inverted steel hook formed from $\frac{1}{2}$x3$\frac{1}{2}$-in. steel. This hook is placed over the secondary crossarm on the pole. Rope lashing is used to fasten the gin to the pole at the primary arm level.

Blocks used in hoisting the transformer are fastened in an eye at the end of bracket of $\frac{1}{2}$x2-in. steel, which projects 12 in. from the vertical gin mast. A sketch of the gin is shown.




ASSEMBLY DETAILS of transformer gin

* This series began in "Electrical World," Dec. 11, 1943, issue.

**Two good names to include in your present and postwar plans for switchgear, switchboards and panels. No contract too BIG none too small to receive the personal attention of our skilled Electrical Engineers.**

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WOLFE & MANN
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SWITCHGEAR • SWITCHBOARDS • PANELS
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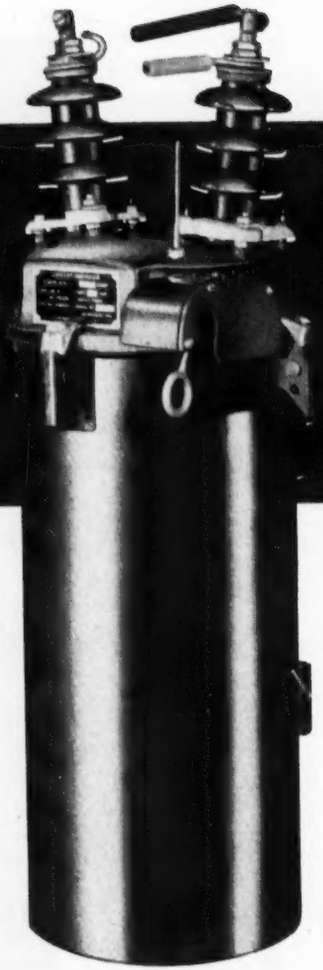


# KYLE

WITH the use of a minimum of mechanical parts, the Kyle Oil Circuit Breaker provides the ultimate in circuit breaker operation. Its dependable hydraulic timing assures long life, ease of operation and unusual resistance to wear and deterioration.

The Kyle Oil Circuit Breaker is electrically and mechanically sound. It has a high interrupting capacity and will not fail in protecting the line.

It is safe from the standpoint of danger to operators or linemen because: (a) the normal position of the breaker is open; (b) operating handle and tank are always dead; and (c) there is no terminal in the bottom of the tank.

## These Pistons are the heart of the KYLE Oil Circuit Breaker

One of these pistons automatically operates the time delay mechanism of the Kyle Oil Circuit Breaker. It provides a fast opening on each shot, up to lockout, piston which is actuated upward by the pumping of oil under the

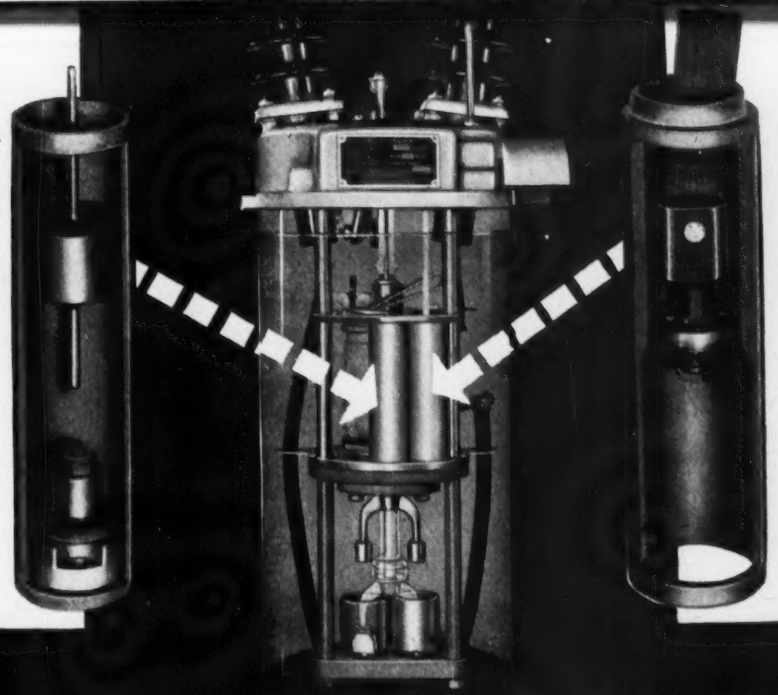
complete cycle of operation after clearing this fault. Should the fault of the line be permanent, the breaker will lock out on the fourth operation. The other

**One of these pistons automatically operates the time delay mechanism of the Kyle Oil Circuit Breaker. It provides a fast opening on each shot, up to lockout, be permanent, the breaker will lock out on the fourth operation. The other**

piston which is actuated upward by the pumping of oil under the piston in measured amounts. The plunger acts as a pump, making an injection each time the breaker opens.

After four operations in succession the piston is driven high enough to trip the release latch, opening the breaker to the lockout position. When fault is corrected, the breaker is reclosed manually by raising the handle to the up position.

If it is not necessary for the breaker to lock out, this piston settles back to its initial position, re-setting the breaker for another complete cycle of operations.



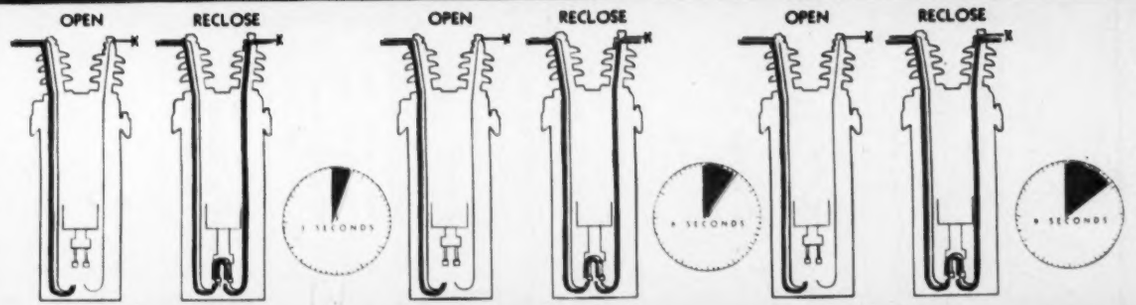
which a cutaway view is shown here. This piston is attached to the contact closing mechanism through the Bakelite tie link and rides in the cylinder as shown.

The piston moves up as the contacts open. Reclosing of the contacts is hydraulically delayed by restricting the oil flow past the piston while it is in the narrower upper cylinder.

When the piston reaches the wider lower part of the cylinder, free drop results in fast closing of the contacts. This gives a delayed interval (3 seconds) before the breaker is closed again.

## How the Kyle Circuit Breaker Operates

The Kyle Circuit Breaker is so designed that each opening is fast and each closing requires an interval of three seconds. On temporary faults the breaker will operate one, two or three times as may be required, resetting itself for a complete cycle of operations, but will lock out on the fourth operation should the fault be permanent. When the fault condition on the line is corrected, the breaker can be manually reclosed by raising the handle to the up position.



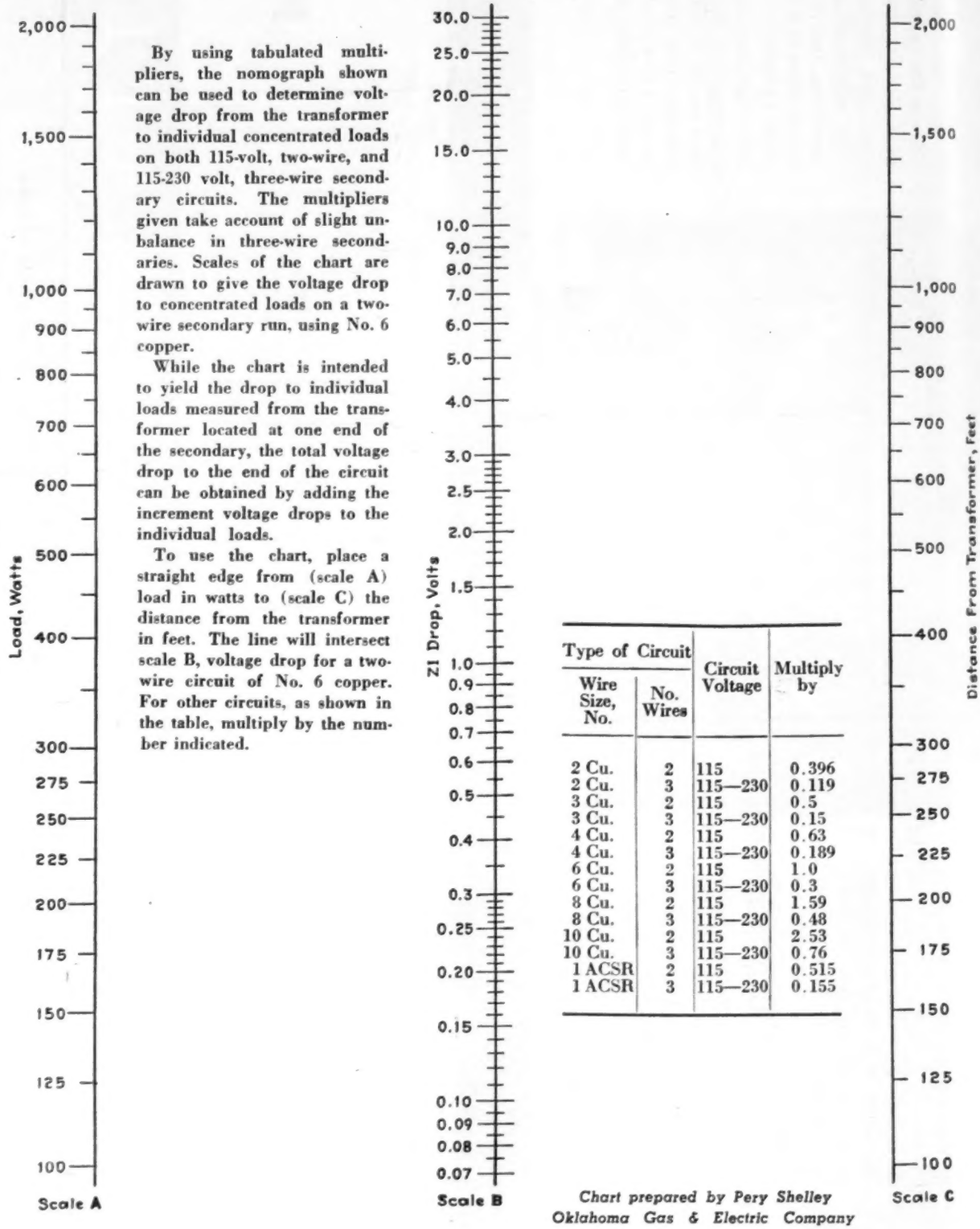

## Ratings of the Kyle Circuit Breaker

Volts: 2300 to 15,000. Amperes: 3 to 50. Minimum Tripping Current: 8 to 102 amperes. Weight: 135 pounds, with oil.

# KYLE CORPORATION

SOUTH MILWAUKEE, WISCONSIN

# HOW TO DETERMINE SECONDARY VOLTAGE DROP TO CONCENTRATED LOADS




By using tabulated multipliers, the nomograph shown can be used to determine voltage drop from the transformer to individual concentrated loads on both 115-volt, two-wire, and 115-230 volt, three-wire secondary circuits. The multipliers given take account of slight unbalance in three-wire secondaries. Scales of the chart are drawn to give the voltage drop to concentrated loads on a two-wire secondary run, using No. 6 copper.

While the chart is intended to yield the drop to individual loads measured from the transformer located at one end of the secondary, the total voltage drop to the end of the circuit can be obtained by adding the increment voltage drops to the individual loads.

To use the chart, place a straight edge from (scale A) load in watts to (scale C) the distance from the transformer in feet. The line will intersect scale B, voltage drop for a two-wire circuit of No. 6 copper. For other circuits, as shown in the table, multiply by the number indicated.

| Type of Circuit | | Circuit Voltage | Multiply by |
|---|---|---|---|
| Wire Size, No. | No. Wires | | |
| 2 Cu. | 2 | 115 | 0.396 |
| 2 Cu. | 3 | 115—230 | 0.119 |
| 3 Cu. | 2 | 115 | 0.5 |
| 3 Cu. | 3 | 115—230 | 0.15 |
| 4 Cu. | 2 | 115 | 0.63 |
| 4 Cu. | 3 | 115—230 | 0.189 |
| 6 Cu. | 2 | 115 | 1.0 |
| 6 Cu. | 3 | 115—230 | 0.3 |
| 8 Cu. | 2 | 115 | 1.59 |
| 8 Cu. | 3 | 115—230 | 0.48 |
| 10 Cu. | 2 | 115 | 2.53 |
| 10 Cu. | 3 | 115—230 | 0.76 |
| 1 ACSR | 2 | 115 | 0.515 |
| 1 ACSR | 3 | 115—230 | 0.155 |

*Chart prepared by Pery Shelley*
*Oklahoma Gas & Electric Company*

# AIDING WOMANPOWER ON THE HOME FRONT

"Two million flatirons will be made. No movable parts are involved and supplies of materials are adequate to cover the program. Further, flatiron production is considered a must—because its lack forces individuals to resort to commercial laundry services, already strained beyond efficient capacity."

Put aluminum sole plates on those irons and you boost their efficiency. Heat travels fast from heating element to working surface, because aluminum has such high heat conductivity. What an easy way to speed the laundry work by the country's woman power!

Aluminum sole plates have proved themselves. They were used on thousands of electric irons before the war sidetracked from civilian production all of the metal Alcoa could make. Their lighter weight was utilized in two ways; to broaden their ironing surface, thus speeding up their work, and to achieve maximum lightness.

There now exist procedures under WPB whereby you may be able to obtain approval for the use of aluminum on your projects. Those who wish to use aluminum for the above purpose should apply to Aluminum and Magnesium Division, WPB, Washington 25, D. C.

Alcoa engineers will gladly work with you on fitting aluminum into your products. Write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

**ALCOA** ALCOA ALUMINUM REG. U. S. PAT. OFF. **ALUMINUM**

**The FRAHM VIBRATING-REED HAND TACHOMETER** requires no contact with the rotating element and is unique for measuring speed of totally enclosed machines and other equipment where the end of the shaft is not accessible. The only mechanism is a set of accurately tuned steel reeds which vibrate by resonance according to the speed of the machine with which the instrument is held in contact.

This principle and the method of indication are unique among speed measuring instruments. The Frahm Tachometer is as accurate as it is simple, with no parts to wear, adjust, lubricate or renew. It can be used in any position and will give years of trouble-free service. For hand use in servicing, installation and maintenance work; also built in types for permanent mounting. Various ranges available from 900 to 30,000 r.p.m.

*For a complete description of Frahm Tachometers together with lists of types and ranges commonly supplied, write for Bulletin 1710-W.*

**The JONES HEAVY DUTY HAND TACHOMETER** is used for indicating r.p.m. and surface speeds of all types of machinery in which the moving parts are readily accessible. Simple, rugged and reliable, it is built to maintain accuracy in hard, everyday service. Scale has equal divisions throughout the 360 degrees of pointer deflection. The instrument can be operated in either direction of rotation and in any position. Single and triple range models up to 12,000 r.p.m. supplied complete with carrying case and accessories.

*Write for descriptive Bulletin 1710-W.*

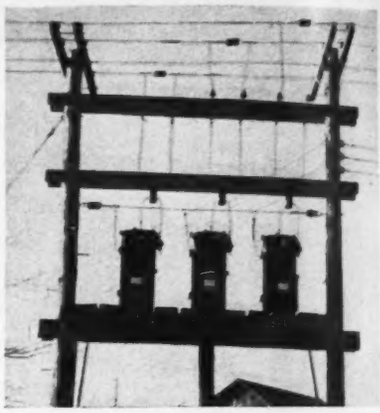
**JAMES G. BIDDLE CO.** • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**


## Save Material-Space With By-pass Switches

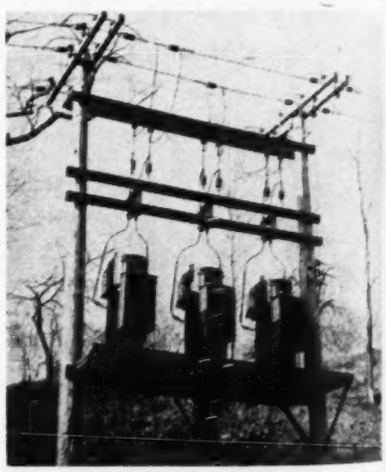

By J. E. GOODWIN

Superintendent, Electrical Engineering Indianapolis Power & Light Company, Indianapolis, Ind.


Three conventional regulator by-pass switches replaced nine disconnect switches formerly used for switching out regulators in each of the installations of 2,400-volt, step and induction type voltage regulators, shown, on the system of the Indianapolis Power & Light Company system in Indiana. A notable saving in material and mounting space resulted, leading to more clean-cut and simplified arrangements.



Case I—Here a set of three 18-kva., 2,400-volt, single-phase step regulators mounted on a wood platform use three R. & I. E. 100-amp. regulator by-pass switches instead of the nine 50-amp. porcelain cutouts formerly employed.



Case II—In this installation of three 38-kva., 2,400-volt, 200/411-amp. induction regulators, on a wood-pole structure, Kearney 400-amp. regulator by-pass switches eliminated

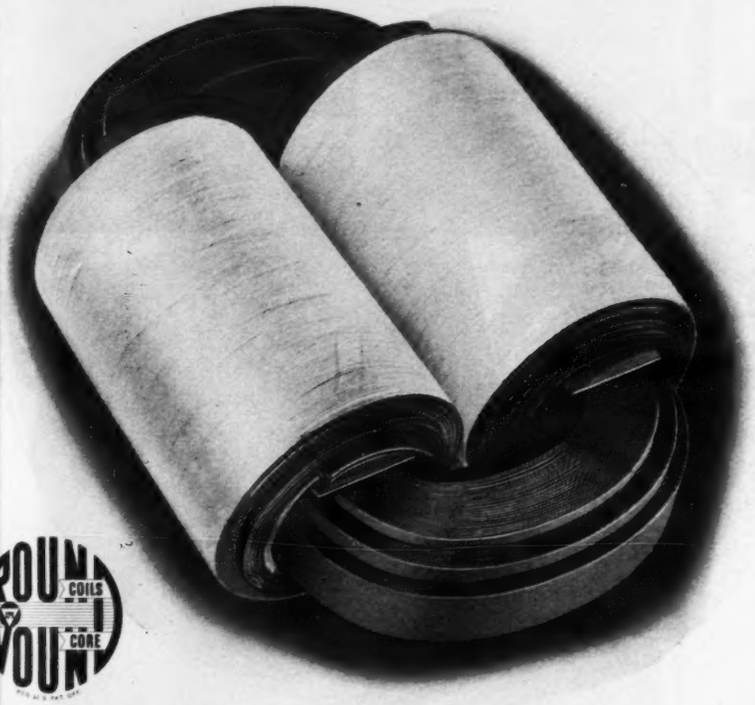
# It's the way it's built

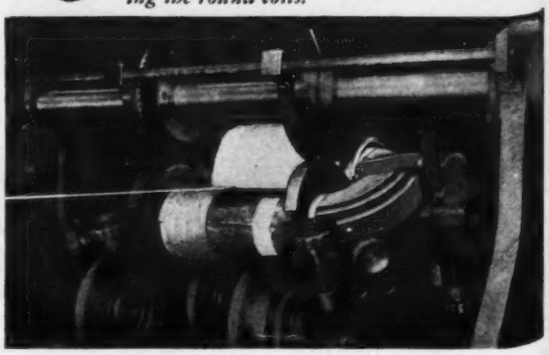
## that makes the L-M ROUND-WOUND transformer a better transformer

*Continuous silicon strip steel in various widths makes possible a wound core.*

**2** *Core, wound from uniform hot-rolled endless silicon strip steel, clamped ready for annealing.*

**3** *Split gears are placed around insulation on each side of core preparatory to winding the round coils.*





**4** *The round coils of the L-M ROUND-WOUND Transformer are wound directly on to the wound core.*

ROUND COILS WOUND CORE

## It offers you more because of its inherently correct design, fine materials, and superior production methods

There are other modern distribution transformers, but no other distribution transformer is designed and built quite the same as the L-M ROUND-WOUND Transformer. . . L-M engineers have developed a method whereby they secure an inherently ideal combination of coil and core assembly. In addition, L-M ROUND-WOUND Transformers are being produced in the most modern manner. The resulting advantages to you are:

1. *Better regulation at all power factors.*
2. *Better ratio of losses.*
3. *Uniformly low exciting current.*
4. *Uniformly high impulse strength.*
5. *High short-time over-load capacity.*

The L-M ROUND-WOUND Transformer is built in accordance with the new NEMA specifications and is available in 1½ to 25 Kva, 2400 to 7620 volts, ratings.

The story of the L-M ROUND-WOUND is told—with many pictures—in bulletin RW-421. Ask for your copy if you have not yet received one.

**LINE MATERIAL COMPANY** LM

# 50 Years of Progress

The growth of the electrical industry since its first flickering glow at Menlo Park has been in part, a story of insulation.

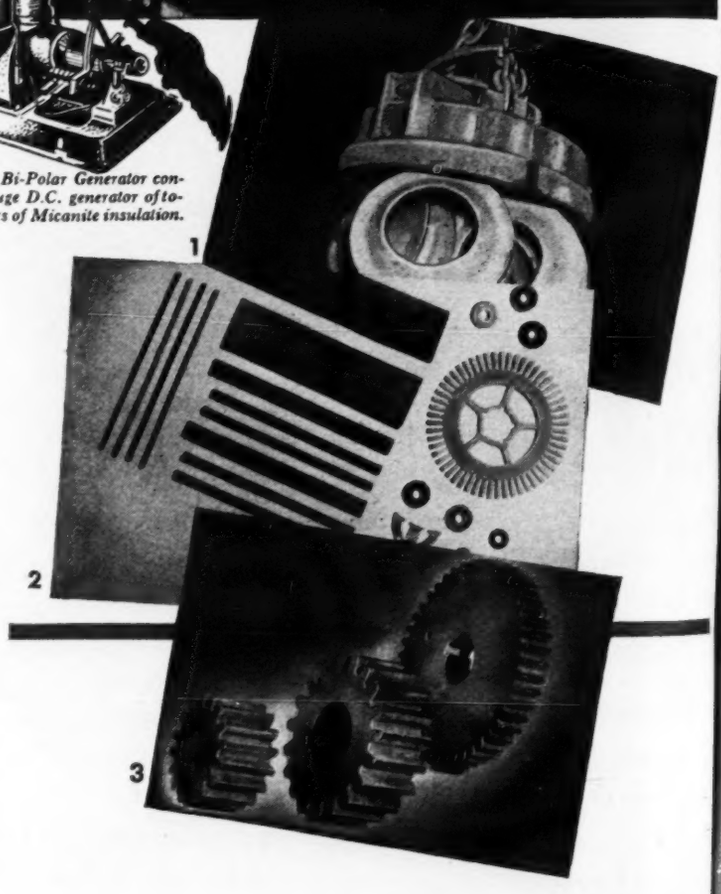
For more than fifty years, the Mica Insulator Company has been supplying insulating materials, keeping pace with the fast growing needs for better and more durable products. The early Edison generators contained Micanite insulation—still a standard specification in electrical equipment. Mica and others of our insulating materials have contributed to the remarkable growth of electronics since the first De Forest Audion made wireless articulate.

Today's insulation must stand up under greater mechanical and electrical stresses. Electrically powered equipment must operate with greater efficiency at higher temperatures. Maintenance of peak loads over extended periods—prevention of output losses over longer transmission circuits—high frequencies undreamed of a few short years ago—all have spelled the need for new insulating products and new forms of old products.

Mica Insulator Company, through continuing research and development, has supplied new and improved products to meet each new demand. Today, in addition to Micanite in many forms, it furnishes raw and fabricated Mica (through its subsidiary, the Munsell Company); Lamicoid—a laminated plastic in the form of sheets, tubes and rods for all insulating purposes; a complete line of varnished fabrics and papers marketed under the well-known "Empire" trade name; and a wide range of insulating specialties sold under the name of "Mico" products.

*Early Edison Bi-Polar Generator contrasted with huge D.C. generator of today—both users of Micanite insulation.*

The Company is therefore in a position to recommend impartially the insulation best suited to each particular application. Our engineers and technical representatives can offer unbiased counsel in discussing and weighing advantages and limitations. Mica Insulator Company products have all been tested in service, in hundreds of applications, and have fifty years of "know how" behind them.



**1.** *This huge power magnet, for fast handling of scrap metals, contains a specially fabricated Micanite insulating ring. Odd-size and unusually shaped parts can be readily cut or molded in Micanite.*

**2.** *A few of many Fiberglas applications are illustrated—slot wedges, armature end, stator piece and insulating washers. Impregnated with plastic resins and laminated under pressure, Fiberglas products combine high dielectric strength and exceptional heat-resistance qualities.*

**3.** *Mechanical Lamicoid is easily punched, sheared, sawed and machined into many shapes. It has the toughness and high impact strength required for such applications as gears, pinions, valve discs.*

# *in Electrical Insulation*

## TYPICAL CHARACTERISTICS OF SHEET MICA

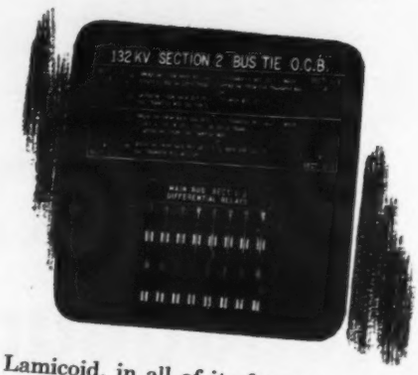
| Chemical Composition (by analysis): | *Muscovite* | *Phlogopite* |
|---|---|---|
| Silica ($SiO_2$) | 45.2 | 40.8 |
| Alumina ($Al_2O_3$) | 38.4 | 26.9 |
| Potash ($K_2O$) | 11.8 | 12.7 |
| Magnesia (Mg O) | — | 7.6 |
| Ferric Oxide ($Fe_2O_3$) | — | 12.0 |
| Water ($H_2O$) | 4.6 | 3.0 |
| Specific Gravity | 2.76–3.0 | 2.78–2.85 |
| Hardness: Moh's Scale | 2.8–3.2 | 2.5–2.7 |
| Max. Temperature (deg.) at which employable | 535 C<br>1027 F | 1000 C<br>1832 F |
| Power Factor at 1000 kilocycles | .0001–.0004 | .004–.07 |
| Dielectric Constant | 6.0–7.0 | 5.0–6.0 |
| Average dielectric strength (volts/mil) of fair stained quality, thickness 2½ mils, tested in oil at room temperature with 1-inch spherical electrodes | 3200 | 2300 |

The selective sorting of Mica radio tube supports is shown in the accompanying photograph.

Close control of all plant operations is a Munsell "must"—from selecting Mica of the right type and grade for a particular application through splitting, gauging, sorting and punching operations. Applications of Mica insulation are so numerous and diverse that its selection for any particular purpose requires long experience and sound knowledge of its properties. These vary with the source of supply—and our long established relations have provided the ability to meet customer requirements with Mica from India, Africa, Brazil, Madagascar and Argentina, as well as from domestic sources.

*Munsell Division*
MICA INSULATOR COMPANY

## LAMICOID




Lamicoid, in all of its forms, assures *permanent* legibility in signs or other display material carrying circuit data, wiring diagrams, safety warnings and a multitude of other uses in power plants and factories.

Available as *Engraving Lamicoid*, a combination, sandwich-type laminate with colored surface and contrasting colored core—suitable for pantograph-engraving or sandblasting—an ideal material when only a few signs of each type are required; *Graphic Lamicoid*, a form in which printed material is incorporated in laminated sheets and furnished in rigid opaque, flexible opaque and translucent, particularly suited for inclusion of fluorescent material; *Translucent Lamicoid*, a flexible sheet in several colors—designed principally for "rear illumination" in both industrial and decorative application.

# Mica Insulator Company

**200 VARICK STREET • NEW YORK 14, N. Y.**

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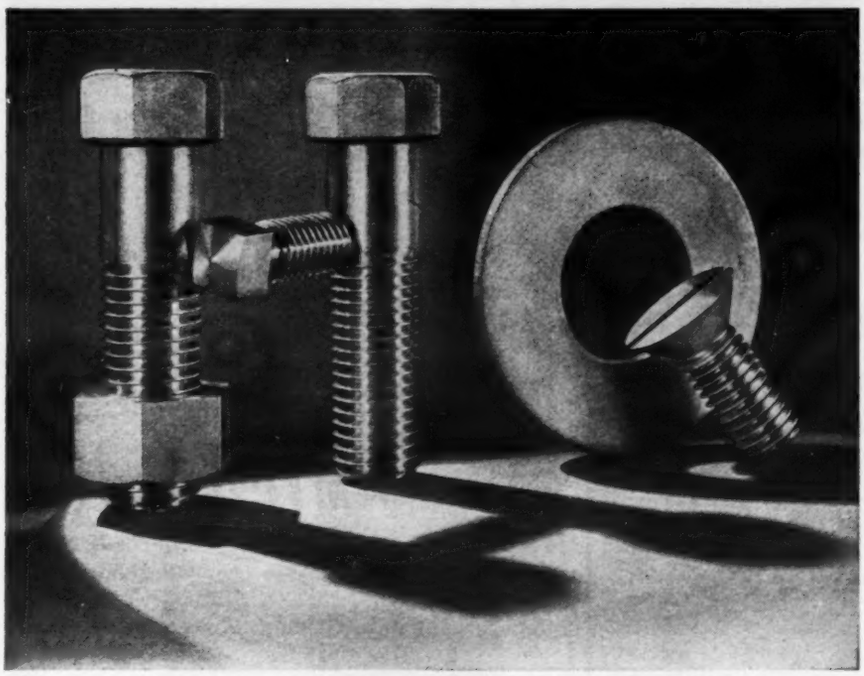
*Representatives in principal industrial centers. Micanite and Super Micanite (built up Mica); raw and fabricated Mica; Lamicoid (laminated plastic) for electrical and mechanical applications; Empire Varnished Fabrics and Papers; Mico insulating specialties.*



*Non-ferrous and Stainless* FASTENING

# Headquarters

HEADQUARTERS is "a chief place of business." So . . . when you need non-ferrous and stainless fastenings, come to Harpers . . . the organization which specializes on the manufacture of bolts, nuts, screws, washers, rivets and specials made of Brass, Bronze, Copper, Everdur, Monel and Stainless . . . an organization not concerned with common steel fastenings.

To serve fastening users, Harper stocks over 4280 different items . . . employs a large staff of engineers and field service men . . . and offers a vast fund of practical non-ferrous and stainless fastening "Know how." Sample this "Know how" by writing (on your letterhead) for a 4-color, 84 page catalog.

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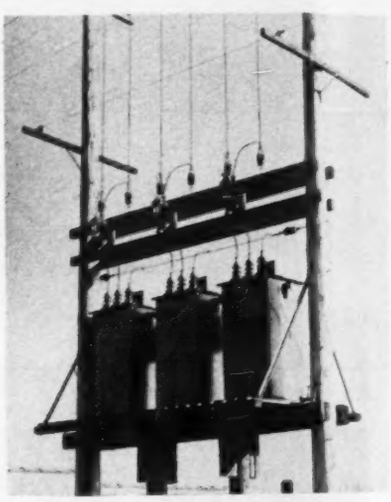
EVERLASTING FASTENINGS

nine 400-amp. disconnect switches previously used.

Case III—The three 18-kva., 2,400,-volt step type regulators were here mounted on individual poles when construction of a platform was not possible. Use is made of R. & I. E. 100-amp. by-pass switches on each pole instead of three cutouts or disconnect switches that would otherwise have been needed to switch these regulators out.



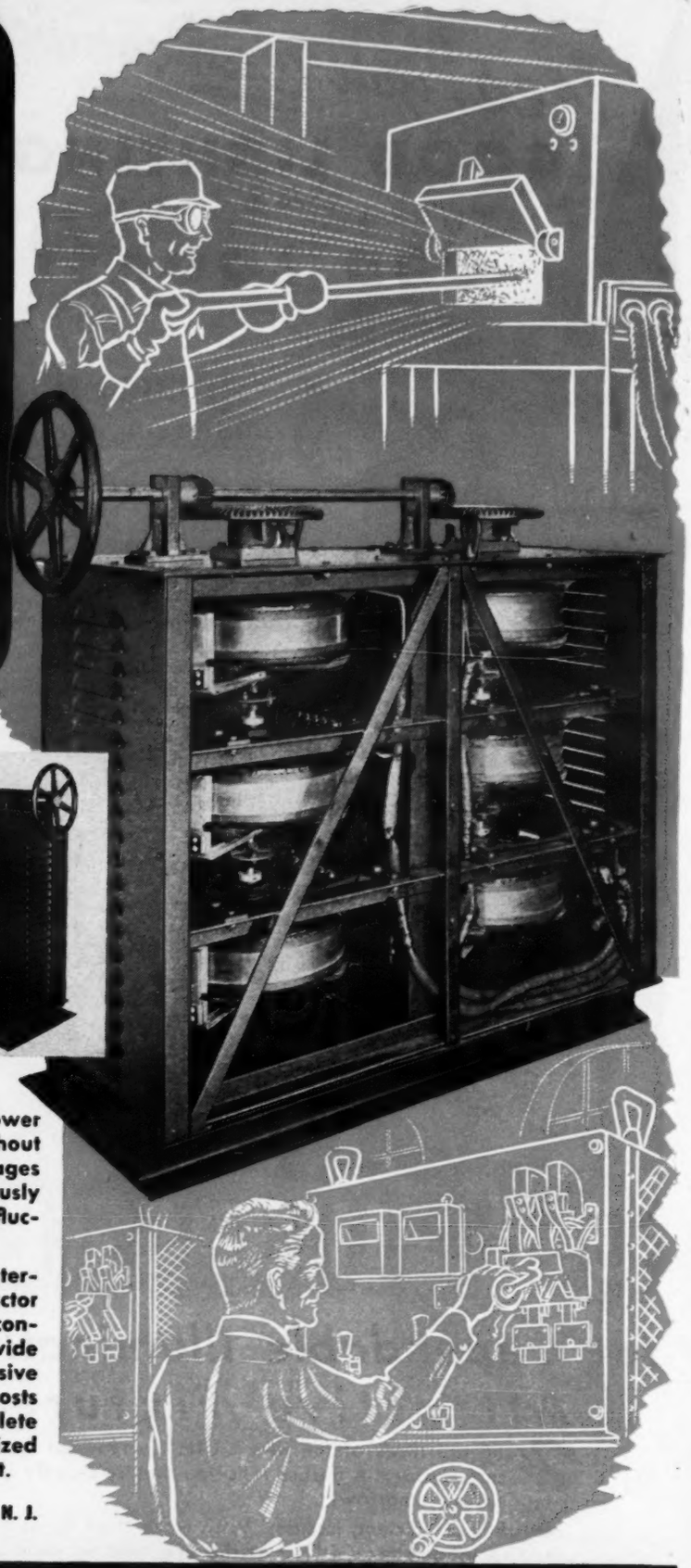
Case IV—Three 38-kva., 2,400-volt, 200/400-amp. step type regulators installed on a pole structure. Wood platform support members were here substituted for steel and three Kearney 400-amp. by-pass switches used instead of nine 400-amp. disconnect switches for by-passing the regulators.

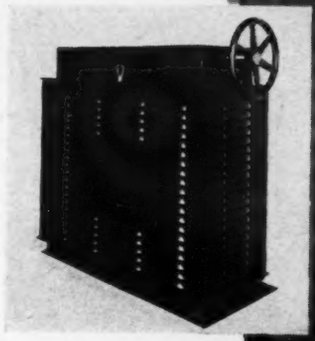
## Lightning Arrester for Signal Systems

Having a number of electrodes which will not weld themselves together, a lightning arrester for signal systems, railway or otherwise, has been developed which prevents a stray path for regular signal currents

# TRANSTAT A.C. VOLTAGE REGULATORS

## OFFER Potentiometer *SMOOTHNESS* and Transformer *EFFICIENCY*





● The Transtat Regulator illustrated was designed for loads up to 30 KVA, 50/60 cycles, single phase, input 230 volts, output 0-230 volts.

● AmerTran Transtats are air-cooled. Compact, fully enclosed for protection of operator and equipment, they present an attractive appearance. Transtats may be used for controlling electric furnaces, variable speed motors, testing equipment, etc.

**The smoothness of a potentiometer without power dissipation, the efficiency of a transformer without cumbersome tap-changing; these are the advantages Transtats offer those who require either a continuously adjustable voltage or a constant voltage from a fluctuating source.**

**With Transtats in the circuit, there are no current interruptions, no arcing, no line surges, no power factor reduction. The velvety smooth, practically stepless control that Transtats provide may be used over a wide range of ratings. Yet Transtats are no more expensive in initial installation, power and maintenance costs than many other voltage regulating devices. Complete information covering manually operated, motorized and fully automatic Transtats available on request.**

**AMERICAN TRANSFORMER COMPANY, 178 Emmet St., Newark 5, N. J.**

**Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission**

**AMERTRAN**

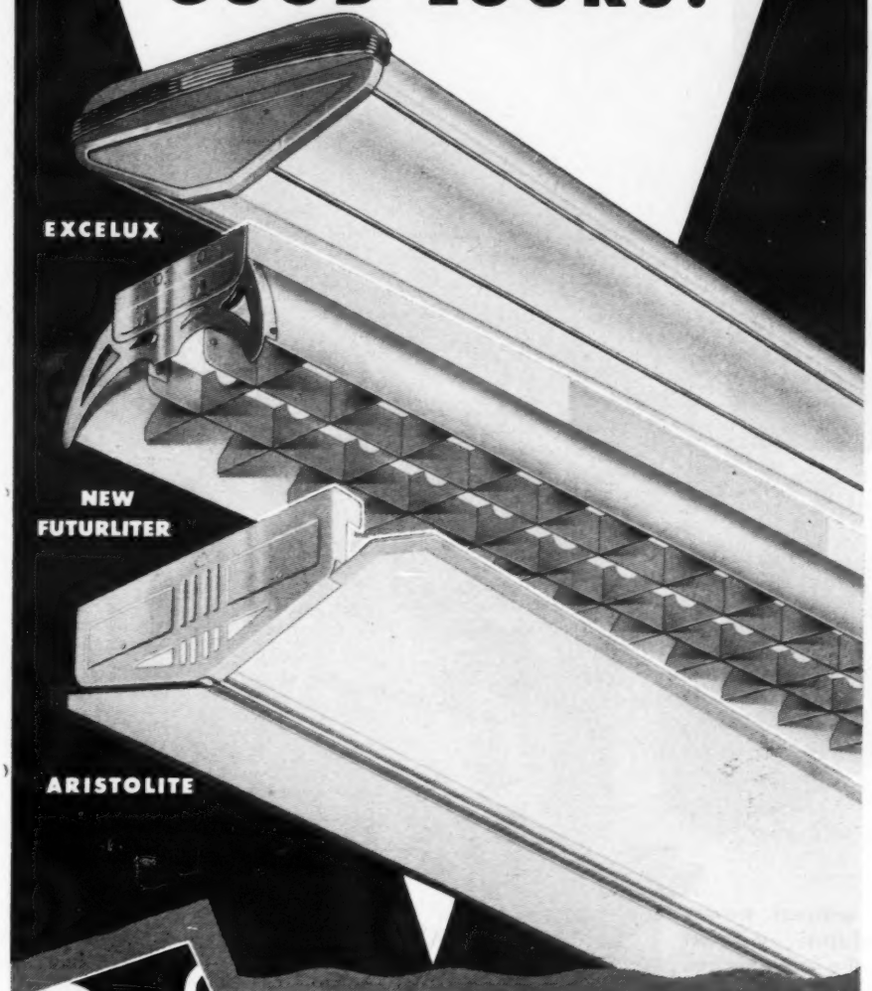
MANUFACTURING SINCE 1901 AT NEWARK N. J.

*Yes, you Can combine*

**GOOD LIGHTING**

*with*

**GOOD LOOKS!**




**Guth FLUORESCENT**

***for Dependable Illumination in Attractive Fixtures!***

HERE are three of the new GUTH Commercial Fluorescent Fixtures. A glance tells you they're smartly styled—modern as tomorrow!

And they're efficient, besides. With more than 40 years of lighting leadership, GUTH has the engineering experience to build real quality into GUTH Lighting.

**Write today for the new Guth Catalog No. 42.**

*Leaders in Lighting Since 1902* **Guth**

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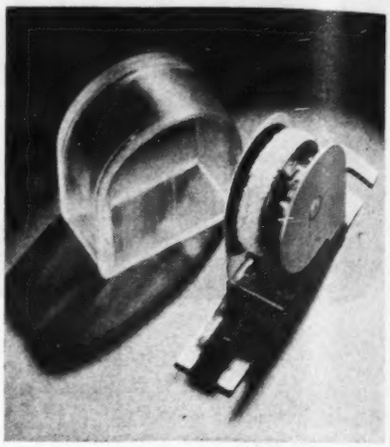
**THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.**


and avoids short circuits and grounds on the system. The device has a large surge capacity and is suitable for mounting on standard ARA terminal blocks.

Construction of the new arrester involves an Autovalve block in series with an air gap, containing a Rutile spacer made of titanium dioxide. A surge voltage, initiated by lightning or other means, breaks down the series gap at a consistently low value. This is due to the pre-ionization of the gap surrounding the Rutile spacer. As the surge current is discharged,



**ARRESTER designed for signal circuits; plastic case removed, showing spears on air gap**

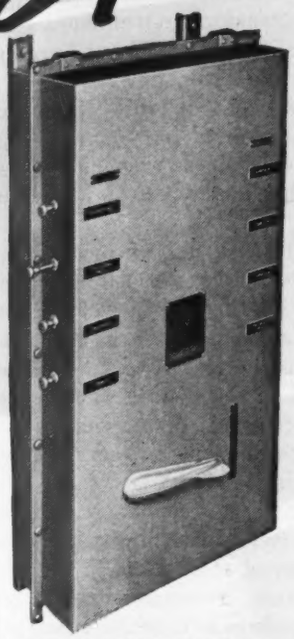
the valve block throttles off the power follow current and the arrester again becomes an insulator which will withstand more than line voltage.

If the arrester is called upon to discharge lightning current beyond its capacity, the Autovalve block may permanently break down, thus losing its ability to cut off power follow current completely. When this happens one of the spears on the spear gap will burn away and the circuit will be interrupted. There is not enough metal in the electrode to cause bridging of the gap. Since there are many spears in parallel, the arrester can continue in service and can again flash over. Each time this happens another spear is burned off, if the block has been damaged. With the block undamaged there is no noticeable burning of the spears.

A transparent plastic case permits visual inspection of the gap so that it is at once apparent whether the arrester is in a satisfactory condition or not. This Westinghouse arrester type RVS can be used on circuits up to 650 volts d.c. or 175 volts a.c. It will handle 10,000 amp. of surge current.

# SQUARE D PANELBOARDS

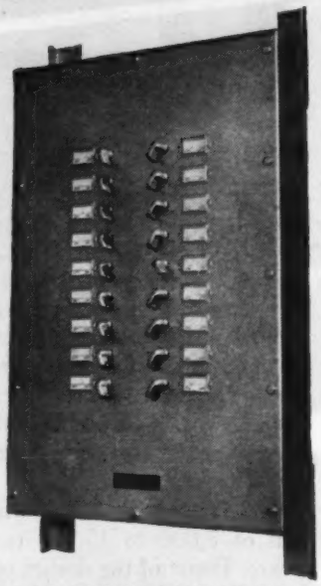
## WITH *Special Purpose* ENCLOSURES



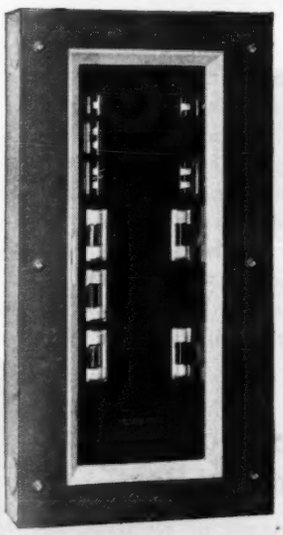
**WATER-RESISTING ENCLOSURE** with externally operated circuit breakers. Side-operated plunger handles reduce depth dimensions.

**WITH BRANCH CIRCUITS OF**
**15 TO 600 AMPERES**
**115 TO 600 VOLTS A.C.**
**125 to 250 VOLTS D. C.**

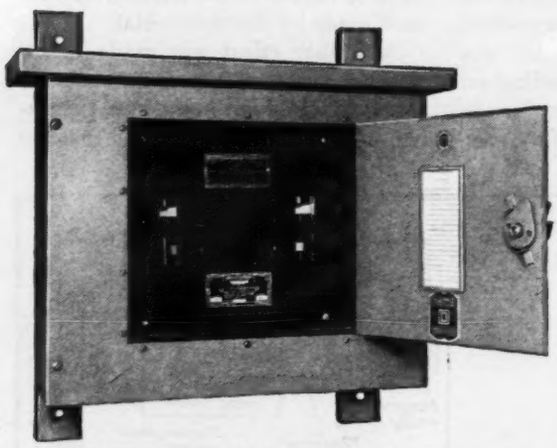
• These are only a few of the many types of special enclosures built by Square D. Regardless of your particular requirements, the nearest Square D Field Engineer can meet them. You'll find him a source of sound counsel in determining the best type of equipment for any given application.



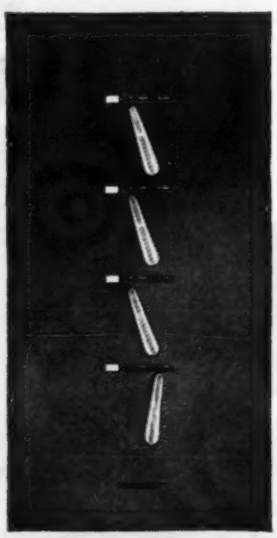
**DUST-TIGHT AND VAPOR-PROOF ENCLOSURE** with externally operated circuit breakers Rotary type handles on front are easy operating and self-indicating



**DUST-RESISTING ENCLOSURE** for fusible or circuit breaker panels. Handles are recessed as safeguard against breakage.



**WEATHERPROOF ENCLOSURE** for all types of panels, both fusible and circuit breaker. Top is extended and flat instead of sloped, thus facilitating conduit entrance.



**DUST-TIGHT AND VAPOR-PROOF ENCLOSURE** with lever-type handles for easy operation of high capacity breakers.

**ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS**

# SQUARE D COMPANY

**DETROIT • MILWAUKEE • LOS ANGELES**

# LOAD SERVICING

Industrial • Commercial • Rural • Residential

## Design for 5-Kw. Poultry Scalder

By JOHN M. LARSON
Rural Service Department,
Northern States Power Company
Minneapolis, Minn.

Design of a 5-kw., accurately controlled electric poultry scalder capable of handling 100 turkeys per hour has been developed by the rural service department of Northern States Power Company for turkey growers in its service area. This heater has been found suitable for farms with an output of 5,000 to 15,000 turkeys per year. Heart of the design is a special combination thermostat and thermal relay control which provides the close regulation of temperature essential for proper scalding.

Semi-scald requires control of water temperature within less than 1 deg. Feathers must be loosened, but the skin must not be burned or cooked. Optimum temperatures lie between 126 and 129 deg. F., depending on tenderness of skin. Massachusetts State College suggests the following temperature schedule for different birds:

| | |
|---|---|
| Individual broilers | 126 deg. F. |
| Young turkeys | 126 deg. F. |
| Young broilers | 127 deg. F. |
| Roasting chickens | 128 deg. F. |
| Roasting fowl | 129 deg. F |

Temperature control using a thermostat to operate a magnetic relay may give satisfactory temperature control; however, contact points tend to burn and stick. In the illustrated design this tendency has been corrected by installing a thermal relay between the thermostat and the magnetic relay switching the load.

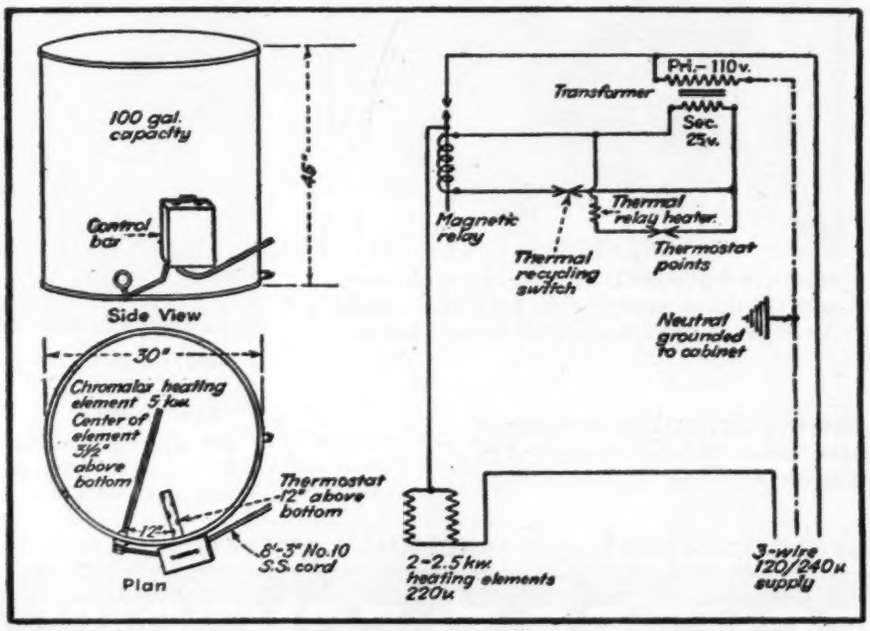
The thermal relay has a heating element along the back of a bimetallic strip that carries the contact points. When break occurs it is positive. The contact points cannot remake until the heating element of the thermal relay cools. This action takes place without regard to the number of contacts made by the thermostat.

A further effort was made to increase the reliability of the temperature control circuit and assure permanent adjustment by providing that the circuit through the thermostat point, the heating element of the thermal relay and the coils of the magnetic relay be opened through a small transformer with a secondary voltage of 25 volts. This low voltage further reduced the possibility of contact troubles.

First installations of this heater were made on farms with 110-220-volt, three-wire service. The neutral was used for equipment ground. The control transformer, mentioned above, was specified with a 110-volt primary. For normal farm operation there is no reason for departing from these plans; however, for commercial use a 220-volt primary should be used and other methods used for grounding.

The tank should, of course, be well insulated; the insulating section should be sealed to prevent moisture from getting into the insulation and reducing its effectiveness. Tank and equipment shown were manufactured by the Specialty Manufacturing Company, St. Paul. The thermostat was a standard thermostat of the White Manufacturing Company extended for sensitivity. This company also makes the thermal relay used.

Various recommendations have been made as to immersion time to be used with semi-scald heaters. From Massachusetts comes the statement that at 128 deg. F. immersion should be about 30 seconds for tender broilers, slightly higher for more mature birds. Other recommendations suggest 20 seconds for very tender birds, 40 seconds for more mature and one minute for turkeys. The exact temperature should not be made the controlling factor for immersion time because if temperature is too high certain parts will be burned before the water reaches other parts and loosens the feathers. It is suggested that the operator "jostle" the birds about somewhat in order to insure water reaching the skin quickly.




SPECIAL CONTROL for 5-kw. semi-scald heater for poultry farms holds water temperature within 1 deg. of desired temperature

•

## Record of Hartford "Trading Post"

Shortages of electrical appliances due to war restrictions upon electrical equipment production for the civilian market recently led the Hartford (Conn.) Electric Co. to establish a "Trading Post" by which persons having surplus appliances can dispose

# NO SQUARE PEGS For Sale

**General Electronics Industries Specializes in Specific Applications of Electronics to Solve Individual Production Problems**

● For assistance in your postwar production planning, you are invited to call upon the research engineering skill, experience and facilities of one of the largest organizations specializing in electronics.

General Electronics Industries is prepared at this time to study your electronics requirements and to design or develop the application that will fit your individual purpose. Thus, you will gain a head start in your future postwar production, with the perfect electronic devices General Electronics Industries will be ready to supply as soon as its manufacturing facilities are no longer engaged in all-out war effort.

Write to Engineering Department, General Electronics Industries, 342 West Putnam Avenue, Greenwich, Connecticut.

ARMY-NAVY "E" WITH STAR awarded to Auto-Ordnance Corporation for continued excellence in production of "Tommy" Guns.

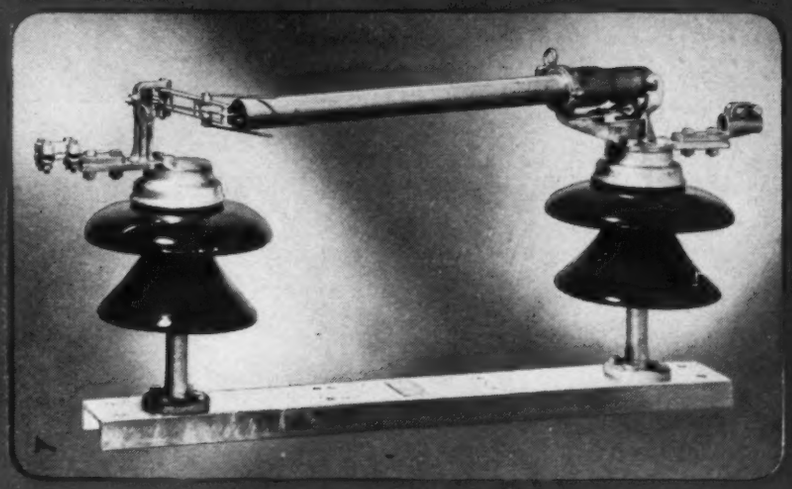
GENERAL Electronics INDUSTRIES

TRADE-MARK REG. U.S. PAT. OFF.

*Division of Auto-Ordnance Corporation*

GREENWICH • STAMFORD • BRIDGEPORT • NEW MILFORD • NEW YORK

Built to Last



HI-VOLTAGE

TYPE T-F-U FUSES

● Here is a unit that will fit into the most modern station design. These fuses may be mounted horizontally or vertically.

The interrupting time is extremely short. When the lower ampere links are used the clearing time is so short that the available short circuit amperes of the circuit may not be reached. On tests with 10000 amperes available the short circuit current was limited to 910 amperes.

By this fast operation the likelihood of damage attending heavy fault currents is reduced almost to the point of elimination.

HI-VOLTAGE

EQUIPMENT COMPANY

2891 East 79th Street • Cleveland 4, Ohio


them to others seeking such devices, on terms agreed upon by the participants. Since the Trading Post was started, about Dec. 1, 1943, a total of 158 appliances had been listed by Jan. 12, 1944, and 77 of these were reported as sold. Of 46 electric ranges listed, 23 were sold; all of 4 refrigerators indexed were sold, and 2 out of four water heaters. Two space heaters out of three listed, three vacuum cleaners out of seven, nine out of 14 electric irons, six out of eleven ironers, a dishwasher, three out of twelve toasters and 24 out of 56 miscellaneous appliances had been sold. Since Oct. 1, 1943, about ten old electric irons per week have been sold, the company allowing $1 each for these prior to the establishment of the Trading Post.

•

## Appliance Exchange Sells Six Out of Ten


By E. J. STOCKER

Superintendent Merchandise Stores, Wisconsin Electric Power, Milwaukee

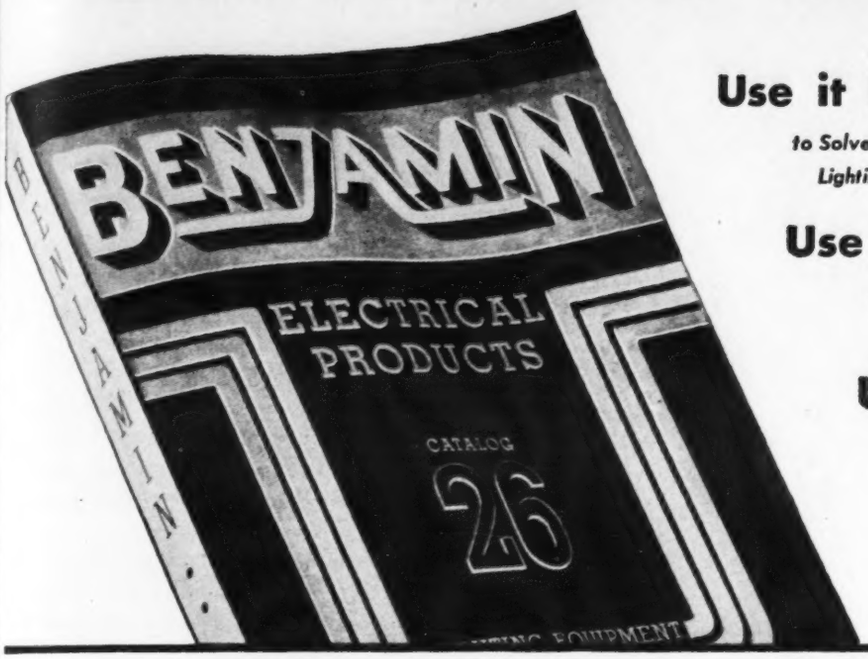

Between March and December of 1943 more than 2,800 electric appliances lying unused in the homes of Milwaukeeans found their way into the hands of eager buyers through a unique wartime service of the Wisconsin Electric Power Company. Paradoxically, each of these sales was made possible by the company, yet the utility actually took no part: merely brought buyer and seller together on terms favorable to a sale.

Through advertising run twice a month in each of two local dailies customers with idle appliances for sale are asked to identify themselves and their appliances on a mailing coupon that is part of each advertisement. In nine months time some 5,100 idle appliances were registered through these coupons. To each coupon clipper the company sent a return addressed postcard asking for "sufficient information to enable a prospective buyer to determine whether he is interested in your appliance." Space is provided on the card for nameplate data, original cost, approximate age, condition, selling price, make, model.

When received by the company the data on these cards is transferred to individual file cards, which are grouped by classes of appliances awaiting the arrival of buyers.

As inquiries about available appli-

# Use Your Benjamin CATALOG 26




**Use it Now**

*to Solve Immediate War Production Lighting Problems*

**Use it Now**

*In Your Plant Reconversion Planning*

**Use it Now**

*to Help You Plan Post-War Plant Lighting Improvements*

Look to your Benjamin Catalog No. 26 for the answers to your immediate and post-war lighting and floodlighting problems. In it you'll find the complete data you need for proper specification of lighting equipment to meet the requirements of the seeing task and those of the location itself. Whether you require incandescent, fluorescent or mercury vapor lighting units . . . for general or localized lighting . . . indoors, outdoor, hazardous or other locations . . . you'll find your answer in Catalog 26.

When you use Benjamin Catalog 26 for planning and specification you are assured of securing lighting equipment that is designed and constructed to provide the utmost in efficiency and durability. Every Benjamin fixture is the product of 40 years of specialization in industrial and utilitarian lighting, and is warranted to comply with all recognized illumination, electrical and mechanical standards and applicable RLM standard specifications.

For those without a copy of Catalog 26, a war-time reprint, just off the press, is available without cost or obligation. Write or mail coupon to Benjamin Electric Mfg. Co., Product Information Dept. K, Des Plaines, Illinois.

**PARTIAL LIST OF CONTENTS**

Section 1 Illumination Design Data
Section 2 General Lighting Equipment
Section 3 Outdoor Lighting Equipment
Section 4 Suspensions, Covers and Wire Guards
Section 5 Explosion Proof and Dust Tight Equipment
Section 6 Vapolets and Water Tight Equipment
Other sections on Fluorescent Lighting Equipment, Floodlighting units, Wiring Devices, Mercury Lamp units and Signals.

**BENJAMIN** TRADE MARK
*Lighting Equipment*

Distributed Exclusively Through Electrical Wholesalers

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*If You Haven't Catalog 26*
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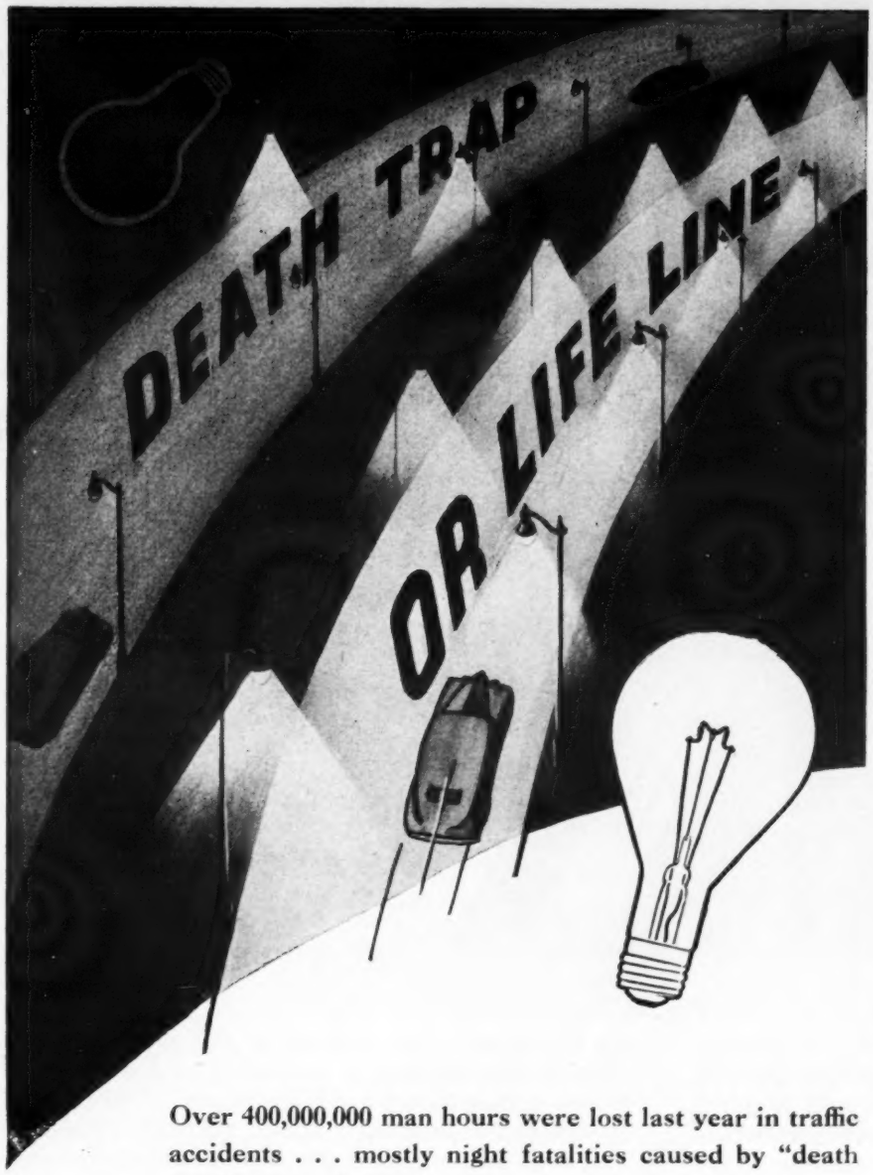
**Benjamin Electric Mfg. Co.**
Product Information Dept. K
Des Plaines, Ill.

Please send me, without cost or obligation, a complimentary copy of the new war-time edition of the BENJAMIN CATALOG No. 26.

Name.....Title.....
Company.....
Address.....
City.....State.....




Over 400,000,000 man hours were lost last year in traffic accidents . . . mostly night fatalities caused by "death trap" thoroughfares.

Proper candlepower distribution of luminaires at minimum spacing is important. But of greater importance is the need for lamps that will not fail long before their definite burning life specifications, and cause dangerous, dark, vulnerable spots.

Because of quality manufacture, rigid tests and inspection, and elimination of defects, SLATER Lamps not only deliver an exceptionally high lumen output but provide maximum rated light and life, thereby minimizing the necessity of frequent lamp replacements . . . making life lines of your thoroughfares . . . not death traps.

*Catalog upon request.*

**SLATER ELECTRIC & MFG. CO.**

BROOKLYN, NEW YORK

*MANUFACTURERS OF STREET LIGHTING LAMPS, AND PRECISION ELECTRONIC TUBES*

**Results of Appliances Exchange March 1 to November 26**

| | Idle Appliances Reported for Sale | Appliances Sold | % Sales Reported |
|---|---|---|---|
| Casseroles | 46 | 46 | 100 |
| Clocks | 127 | 37 | 29.1 |
| Coffee makers | 197 | 29 | 14.7 |
| Curling irons | 29 | 4 | 13.8 |
| Egg cookers | 19 | 0 | 0.0 |
| Fans | 274 | 138 | 50.3 |
| Food Mixers | 86 | 62 | 72.1 |
| Hair Dryers | 17 | 7 | 41.1 |
| Heaters | 162 | 123 | 75.9 |
| Heating pads | 18 | 7 | 38.9 |
| Health lamps | 404 | 215 | 53.2 |
| Hot plates | 116 | 99 | 85.3 |
| Humidifiers | 5 | 0 | 0.0 |
| Irons | 765 | 712 | 93.0 |
| Ironers | 378 | 170 | 45.0 |
| Lamps | 3 | 0 | 0.0 |
| Ranges | 273 | 170 | 62.2 |
| Razors | 53 | 11 | 20.7 |
| Refrigerators | 192 | 143 | 74.4 |
| Roasters | 325 | 200 | 61.5 |
| Toasters | 380 | 109 | 28.6 |
| Vacuum cleaners | 280 | 159 | 56.7 |
| Waffle irons | 207 | 61 | 29.4 |
| Washers | 280 | 222 | 79.2 |
| Miscellaneous | 470 | 120 | 25.5 |
| Total | 5,106 | 2,844 | 55.6 |

ances are received by the company an attempt is made to find out in advance just what the prospect wants both as to age, price range, make of appliance, etc. The salesman carefully evaluates these requirements and gives the prospect the names of one or perhaps two owners who appear to have the closest approach to what is wanted and sends him off to the nearest phone to arrange an appointment and negotiate the sale with the owner himself. It should be carefully noted that the company does not attempt to justify any difference between asked price of the owner or bid price of buyer, leaving it for the two to settle in direct negotiation. Only condition imposed by the company is that the owner notify the utility when the appliance is sold and to whom.

The company has direct knowledge of the sale of 2,844 out of 5,106 appliances listed, approximately 55 percent. The possibility exists that the percentage may be 15-20 percent higher due to failure of the owner to notify when an appliance is sold.

This activity is being conducted by three persons in the company merchandising department—two women who handle inquiries and a third who keeps records of transactions and handles inquiries on a part-time basis.

It is reported by those who contact prospective buyers that it is "from two

# Wagner
## TRANSFORMERS

reflect sound engineering and modern manufacturing methods . . .

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

**WAGNER BRANCH OFFICES**

ATLANTA
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BOSTON
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DENVER
DETROIT
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LOS ANGELES
MEMPHIS
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OMAHA
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*Write*
FOR BULLETINS
TU-33 (NOFLAMOL)
TU-181 (POWER)
TU-180 (DISTRIBUTION)

★ ★ ★

**POWER DISTRIBUTION AIR-COOLED NOFLAMOL***
*(NON-INFLAMMABLE LIQUID FILLED)

In army camps, ordnance and power plants, in the oil fields, and throughout the chemical and steel industries, Wagner transformers daily demonstrate their excellence in quality. From the very beginning, the name Wagner has been *synonymous with quality.*

If you are in need of transformers to complete your war production schedules, consult the nearest of Wagner's 29 branch offices, located in principal cities and manned by trained field engineers.

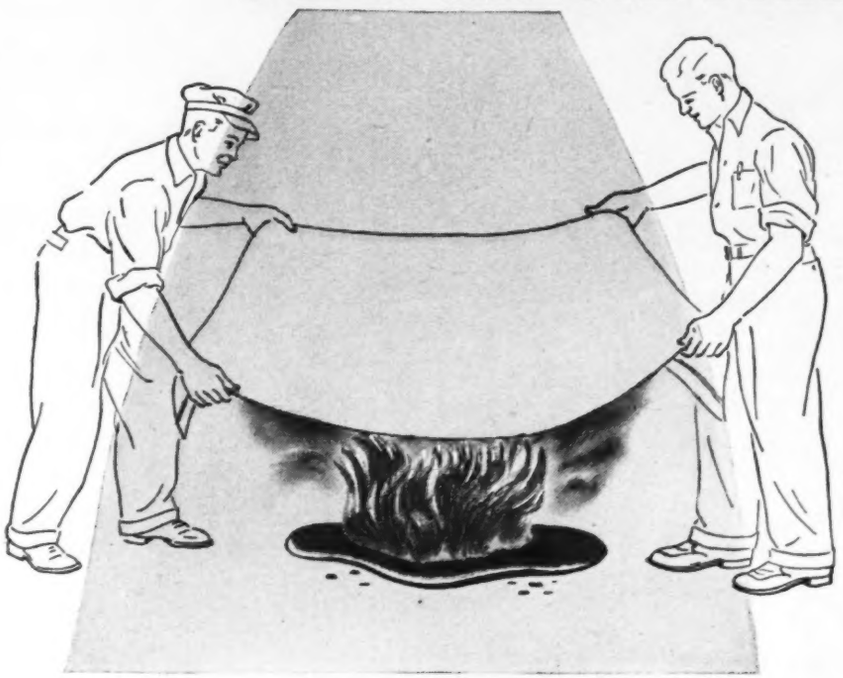
T43-4

Wagner Electric Corporation

ELECTRICAL AND AUTOMOTIVE PRODUCTS

★ ★ ★

# *Imagine* DROPPING A BLANKET OVER AN OIL FIRE



● There isn't a second to lose! Oil ignites rapidly. But FIRE-FOG goes to work *automatically, quickly* — drops like a blanket over the burning area, and only that area. Millions of tiny particles of water form a mist-like spray or "heavy" fog. The fire can't breathe. The cloak of mist cools it, chokes it — the work of quenching the fire has begun almost instantly.

If your plant is menaced by the extra fire hazard of oil or other flammable liquids, an "Automatic" FIRE-FOG System will provide adequate protection. Night and day, FIRE-FOG safeguards against the destruction of costly, perhaps irreplaceable, equipment — against shut-downs and needless losses.

"Automatic" and its predecessor companies have made a half-century study of fire protection methods. This priceless know-how covers every fire-hazard condition. Result: The "Automatic" System you buy is the one that fits your requirements, *adequately* and *exactly*.

*An "Automatic" Engineer will be glad to talk it over with you at your convenience*

"AUTOMATIC" FIRE-FOG

★ IT BLANKETS
★ IT ISOLATES
★ IT QUENCHES

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA ★ YOUNGSTOWN, OHIO

★ ★ ★ OFFICES IN PRINCIPAL CITIES ★ ★ ★

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA RATE OF RISE

TRADE MARK REG. U.S. PAT. OFF.


to three times" as hard to get a prospect interested to the point of contacting the owner of a used appliance as it would be to sell him a new one. Explanation appears to lie in hesitance to buy used equipment and natural reluctance or inertia in contacting a strange owner—sometimes in a remote part of the city.

A complete listing of the number of appliances registered and sold between March 1 and November 26 is shown in the table on page 138.

•

## Lowell Has New Use for Reddy Kilowatt

A brand new use for the personable Reddy Kilowatt has recently been developed by The Lowell (Mass.) Electric Light Corp. and is reported in the Company magazine, "Contact." At the suggestion of its farm specialist, F. H. Peckham, Reddy now adorns a small white flag, which the company is furnishing experimentally to a limited number of important farm and isolated customers who are served from individual transformers or by spur extensions.

In event of an outage the flag is to be attached by the customer to his service pole on the street. Of course it doesn't take the place of the usual manner of reporting an interruption in service; the customer is asked to report it by telephone or otherwise as usual. However, it does accomplish two things. It brings quicker restoration of service for it helps the linemen to locate everyone in the neighborhood in trouble in less time, and it proves of inestimable help to linesmen who may not be familiar with the particular locality. In addition it saves many duplicate service trips.

For instance, during a serious thunderstorm recently, a service crew cleared an outage in West Tewksbury, replacing blown transformers and junction fuses. There being no indication of further trouble in this neighborhood, they proceeded to the next job and inadvertently overlooked an important farm customer served from an individual transformer not readily seen under the prevailing conditions when the line was patrolled. The customer was without service for some time. A Reddy Kilowatt flag in this instance would have shortened the length of this outage without doubt.

# *Fluorescent* operating hints

**No. 1** of a series published by Sylvania for all users of fluorescent lighting.

## HOW TO TEST LAMPS AND STARTERS

If a fluorescent lamp blinks or fails to light early in life, it does not necessarily indicate premature lamp failure. The trouble may be a defective ballast or a faulty starter. However, the first thing to do is to replace both the lamp and the starter with units known to be satisfactory. If the new lamp fails to operate with the new starter in place, loose connections in the wiring or ballast may be the reason, and the electrician should check the entire circuit.

To check the questionable lamp and starter that have been removed, test them in a fixture known to be performing properly, or return them to the maintenance shop for checking on a simply constructed test board.

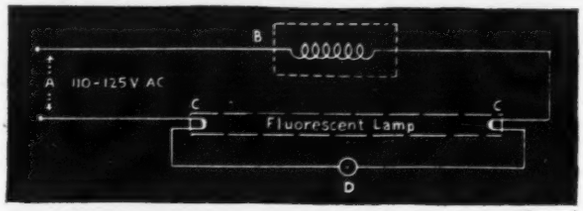



Figure 1

## HOW TO MAKE TEST BOARD

Fig. 1 shows the wiring for a simple test board that can be used to check either lamps or starters. *A* is the connection to the 110-125 volt AC line. *B* is a single-lamp ballast of the same wattage rating as the lamp being tested in *C*, the lamp sockets. *D* is the starter socket.

Fig. 2

## DUMMY-STARTER TESTER

For use with this test board, you can make a dummy-starter tester from a spare or used Sylvania starter by removing the can and connecting the two contacts permanently, Fig. 2. Replace the can and scratch it with a distinctive mark, so that it will not be mistaken for one of your regular starters.

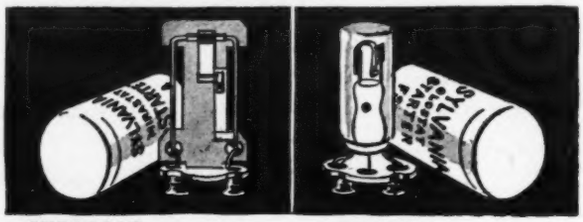
## TESTING THE LAMP

Place the lamp to be tested in lamp sockets *C*, and place the dummy starter in socket *D*. If the lamp is good, both ends of it will glow when the dummy starter is in the socket; and the entire lamp will light when the dummy starter is *quickly* removed. If the lamp does not perform in this way, it is worn out and should be discarded.

## HOW TO TEST STARTER

To test starters on the test board, put a lamp known to be good in sockets *C*, and put the questionable starter in socket *D*. If the starter is good, the lamp will light in less than 30 seconds.

(*CAUTION*: Test No. 2 starters with 15- or 20-watt lamps only; No. 4 starters with 30- or 40-watt lamps only; No. 5 starters with 6- and 8-watt lamps only; No. 6 starters with 100-watt lamps only; and No. 7 starters with 65-watt lamps only.)



**MIRASTAT**—Sylvania's thermal-type starter

**GLOSTAT**—Sylvania's glow-type starter

## STARTERS ARE LAMP-LIFE INSURANCE

The fluorescent lamp starter is an automatic time-delay switch. Mechanically rugged, it enables the fluorescent lamp to establish its lighting arc without the use of high voltage.

Starters cost only a few cents — but they protect your really important investment in fluorescent fixtures and fluorescent lamps. Defective starters shorten lamp life and cause overheating in ballasts. It pays to test your starters and replace defective ones with Sylvania Mirastats or Glostats.

*For Additional Maintenance Information*

**Send for this Free Booklet**

☆ **SYLVANIA ELECTRIC PRODUCTS INC.**

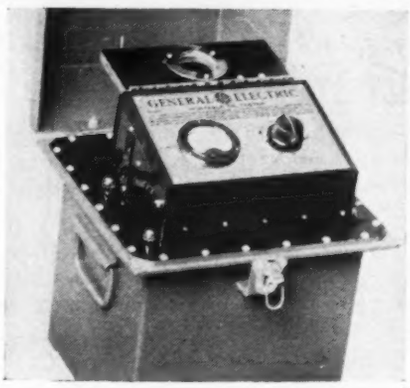
**SALEM, MASS.**

INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

# NEW EQUIPMENT

## Oil Tester

Portable test set for checking dielectric strength of insulating liquids is designed for indoor service and to provide smoothly



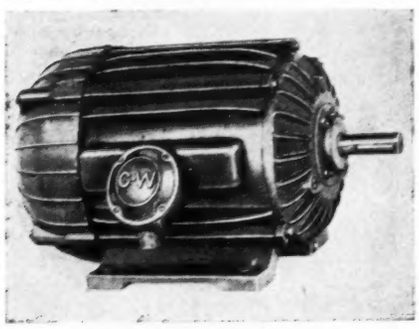

"Cat. 63G400" portable oil tester; test voltages up to 30,000; operates on single-phase, 115- or 230-volt, 25- or 60-cycle circuits; weight, 80 lb. **General Electric Co.**, Schenectady, N. Y.

variable test voltage. The single unit consists of a step-up transformer, a potentiometer which gradually raises the test voltage, a voltmeter, an automatic circuit breaker and an oil-testing receptacle located at the rear of the control panel under a hinged safety guard with a glass window. As soon as the test sample breaks down, the low-voltage breaker automatically opens the circuit.

•

## Motor

Totally inclosed, fan-cooled type motor has been designed for use in atmospheres containing injurious dusts, corrosive vapor or gases, and excessive moisture. It has no cooling ducts. In addition to the mechanical sealing each coil is sealed against moisture, fumes, vapor and dust, by vacuum impregnation process.



"Sealedpower" corrosion-resistant induction motor; ratings, 1 to 15 hp, polyphase. **Crocker-Wheeler Div., Joshua Hendy Iron Works**, Ampere, N. J.

## Combustion Control

Type "P" combustion control. **Leeds & Northrup Co.**, 4934 Stenton Ave., Philadelphia 44, Pa.

System of combustion control for smaller plants and applicable to boilers fired with coal, oil or gas, continuously proportions fuel and air to steam demand, and at the same time controls furnace pressure. To regulate fuel-feed and draft the system provides an electrical balance by which the settings of valve, dampers or vanes are varied in definite proportion to steam demand as directed by a master controller. Remaining draft damper or other device is simultaneously regulated by the furnace pressure controller.

•

## Welders

New models of a.c. welders have moisture-proof insulation and all parts are protected by a coating of moisture-proof paint. Outer case is enamel finished and has gaskets and

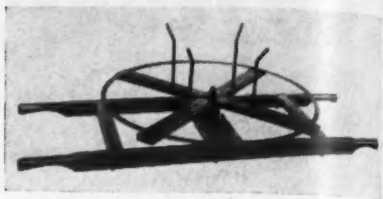
"Bumblebee" all-weather a.c. welders; capacities 300 and 500 amp. **Wilson Welder & Metals Co., Inc.**, 60 East 42d St., New York 17, N. Y.

louvers to prevent entrance of rain. In addition the welder is equipped with a low-voltage contactor which automatically holds the open circuit voltage at approximately 40 volts.

**BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.**

## Wire Reel

For paying out wire a barrow-type reel has a frame and turntable cross members of white oak and base, flange and coil arm castings of malleable iron. Coil arms can



"Cat. 17-A" wire reel; accommodates coils of wire having inside diameters of 12, 18 and 24 in.; frame length 70 in., width 24 in.; wire reel height 19 in.; turntable diameter 43 in.; net weight 60 lb. **W. N. Matthews Corp.**, 3722 Forest Park Blvd., St. Louis 8, Mo.

be adjusted on metal face plates which are used also to protect wood cross arms of turntable. Reel can be furnished without frame for mounting of base casting and turntable directly to truck.

•

## Safety Goggle

All-plastic non-fogging goggle for general industrial utility use has one-piece lens of shatterproof methacrylate which is said to

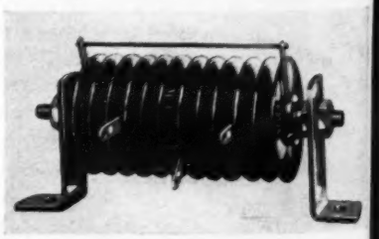
"Model 7" industrial safety goggle. **Watchemoket Optical Co., Inc.**, Providence 3, R. I.

withstand heavy impact, to be resistant to pitting caused by sparks and to shield eyes from every angle. Construction includes curved plastic frame to fit the face snugly, reinforced with brass clip at bridge, and permits easy replacement of lens.

•

## Rectifiers

Units of a line of power rectifiers are stated to be moisture proof and to have permanent characteristics. They are claimed to offer maximum output per unit weight and advantageous temperature characteristics. The units are available for bolt or stud mounting direct to equipment or with mounting brackets.



Disk type selenium rectifiers; seven sizes ranging from ¾ to 4½ in. diameter; output up to 1,000 amp. **Selenium Corporation of America**, 1800 West Pico Boulevard, Los Angeles 6, Calif.

# A Case of Identity

## REQUISITES FOR LIGHTNING ARRESTERS

1. High Protective Level
2. Ability to Carry Heavy Surge Current
3. Good for Both Long and Short Wave
4. No Breakdown on Normal Current
5. Moisture Proof *
6. Operate in All Climates
7. Long Life
8. Field and Laboratory Success
9. Ability to Prevent Line Lock-out
10. Operating Characteristics Unchanged Over Long Service

The men illustrated above are three Electrical Engineers and a Purchasing Agent. These men collaborated in preparing the list of "Requisites for Lightning Arresters" shown at the left. The list was recently published and distributed by a leading Electrical Trade Paper.

* No. 5 was unanimously voted most important.

**OPERATING MEN ASK FOR IT!**
**HUBBARD AUTOGAPS HAVE IT!**

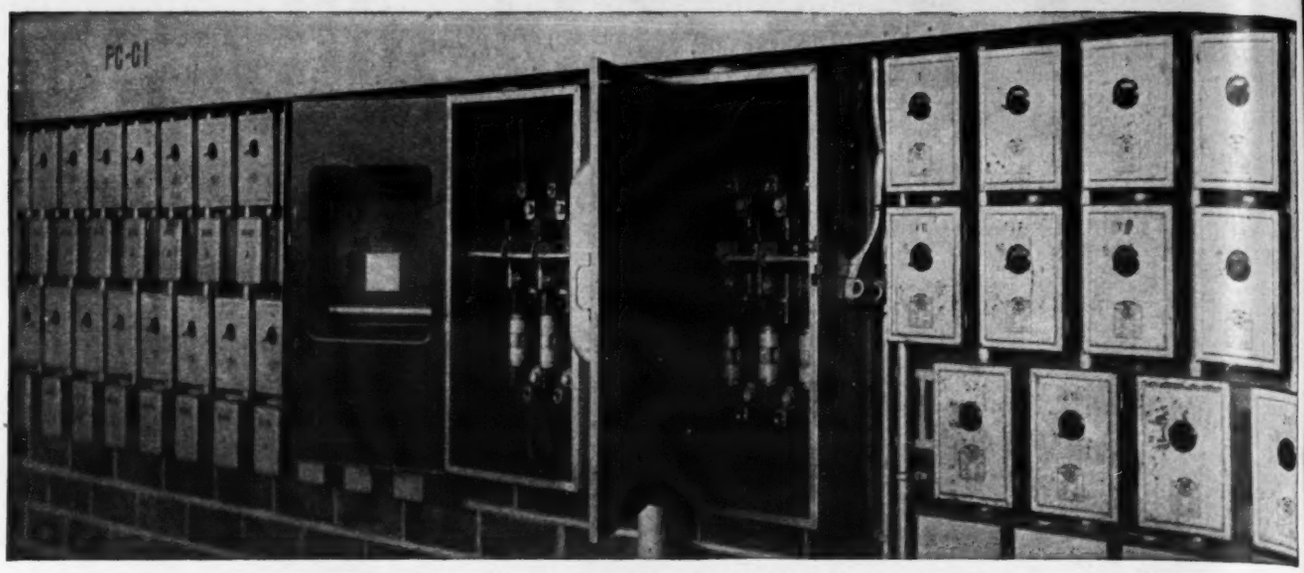
## Hubbard Autogaps Have the Answers

1. Yes! Rapid operation — characteristics are fixed. Breakdown point 55% of insulation strength of equipment.
2. Excellent! In excess of 65,000 Amperes of surge current without failure.
3. Yes! Handles Long and Short Waves with equal ability.
4. No! Gap settings are above possible 60 cycle voltages.
5. Better than moisture proof. Design characteristics for Expulsion Type Arrester not affected by moisture.
6. Yes! High and low altitudes — high and low temperatures have not affected good performance.
7. Yes! Made entirely of time-tested, durable material — virtually unaffected by each operation.
8. Excellent laboratory performance confirmed by several years field experience.
9. Yes! Multiple gaps in series containing *no fusible material.*
10. Field experience proves unchanging values over long period of service. Oscillograms are available.

*In other words . . . these four men might well have written a single word on their list . . . "Autogaps"*

**HUBBARD AND COMPANY**

PITTSBURGH . . . OAKLAND CALIFORNIA CHICAGO



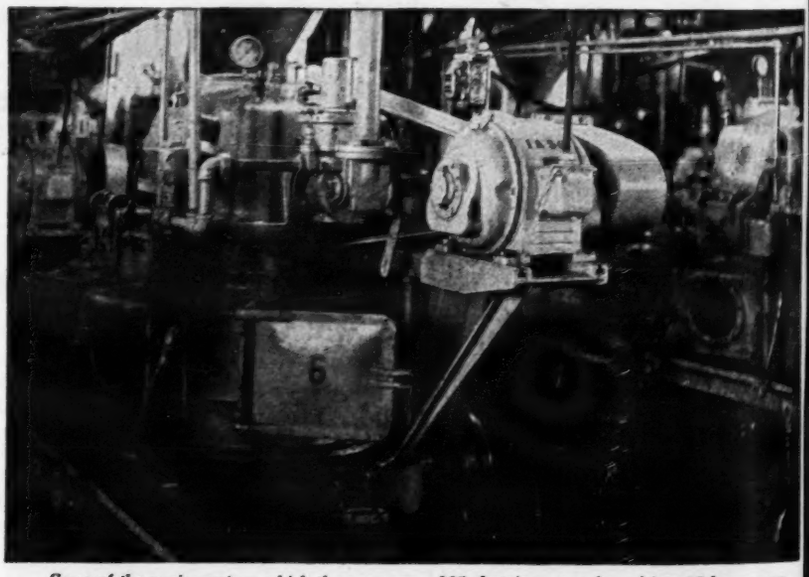

*BUSS Super-Lag fuses are used in feeder and branch circuit switches.*

# "Needless Motor Shutdowns Decreased Where We Installed BUSS Super-Lag Renewable Fuses"

## *Says* Mr. Frank M. Herrick, Chief Engineer, Minnesota Valley Canning Company, Le Sueur, Minnesota

*"Our canning operations are tough on fuses," continues Mr. Herrick, "because our operating season is so limited we operate 22 hours a day—and use the other two hours to clean up the machines. The plants are thoroughly washed, consequently, the steam and moisture tightens motor belt drives. Condensation and moisture in the motors, plus tightened belts, make motor starting conditions a heavy burden on fuses. BUSS Super-Lag fuses have definitely minimized this problem because of the long time-lag and positive contacts of the fuses.*

*"Where we have installed BUSS Super-Lag Fuses we have noticed an appreciable decrease in needless shutdowns, which we credit to the time-lag of BUSS Fuses as well as to their simple design."*



*Some of the equipment on which there are some 365 electric motors from ¼ to 15 horsepower.*

# BUSS Super-Lag

Do you have a tough fuse problem—like the one at Minnesota Valley Canning Company? You can probably solve it as easily as Mr. Herrick did—by using all BUSS Super-Lag fuses.

Buss fuses require no maintenance or periodic inspection. They don't open needlessly. If one opens, you can be sure some condition needs correction. When one opens, it requires less than 45 seconds to renew with an inexpensive link.

**Here is why BUSS fuses greatly reduce or entirely prevent needless blows**

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus, excessive heating which causes fuses to blow needlessly is prevented.

The fuse link used is the famous "BUSS Super-Lag." It has lag-plates attached to it. These give it a long time-lag so that unusually heavy starting current or other harmless overloads will not cause the fuse to blow.

**How to solve the "shutdown problem"**

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses afford. BUSSMANN MFG. CO., University at Jefferson, St. Louis 7, Mo., *Division McGraw Electric Company.*

*The Minnesota Valley Canning Co. plants turned out nearly a million cases of these fine products in 1943.*

**WHY BUSS FUSES DON'T BLOW NEEDLESSLY**

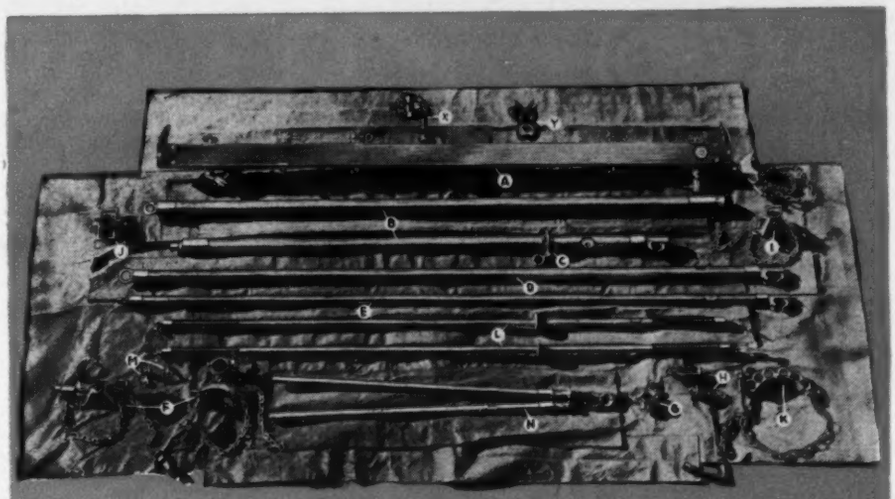
**TEN FEATURES**

**in the design of the FUSE-CASE help make it possible.**

***and* THE SUPER-LAG**

**development in the FUSE-LINK completes the job.**

# FUSES SOLD THROUGH WHOLESALERS

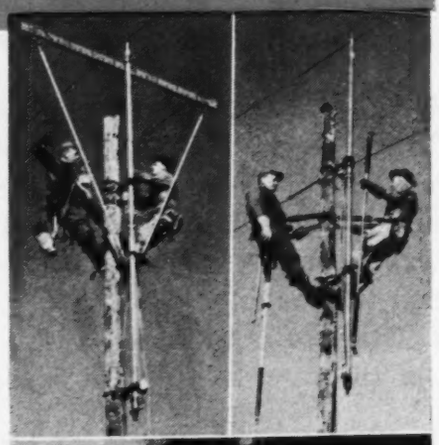


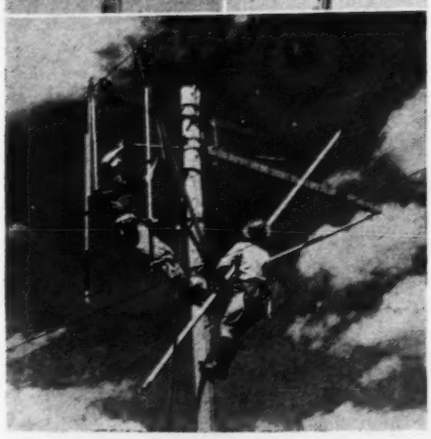
# This rural line maintenance tool set should be included in your Post-War Plans..

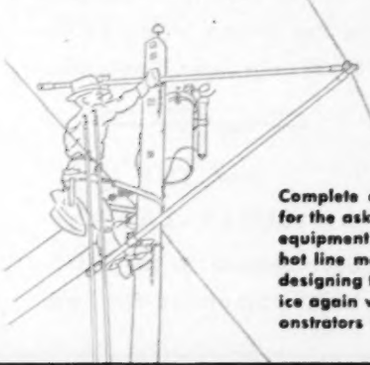
## ...for making line repairs in safety without interrupting service...

Maintenance of all electrical circuits without service interruption will, undoubtedly, be a requirement for public utilities that wish to compete after the war is over. The majority of rural line construction can be maintained with this interchangeable tool set No. 4800-15. This set may be arranged as a lifting arm for hoisting three conductors from a cross arm as illustrated at near right, or as a single wire lift as shown at extreme right, as a side arm as illustrated in the lower photograph, or as a wire tong set to push one conductor to the side as shown in the sketch below. The tool set consists of (A) lifting arm, (B) spliced wire tong, (C) pole band for rope, (D) single wire tongs, (F) wire tong saddles, (G) saddle clamps, (H) clamp extensions, (I) saddle with stirrup, (J) pole stirrup, (K) rope snubbing bracket, (L) tie sticks, (M) universal tie stick fittings, (N) wire cutter, (X) tong extension and (Y) wire holder attachment.

All poles in the tool set are tested to withstand 75,000 volts per foot and all fittings are designed to operate with complete safety to the linemen.







**Complete details on these and other hot line tools are yours for the asking. Your Tips Tool Catalog of live line maintenance equipment explains thoroughly a number of methods used in hot line maintenance work. Tips Tools Engineers are skilled in designing tools for special jobs. They, too, will be at your service again when things return to normal and the Tips Tools demonstrators will be on the job to show line crews how it's done.**

**A·B·CHANCE CO·**
**CENTRALIA, MISSOURI.**

ABC INDUSTRIES


## TECHNICAL LITERATURE

"Copper and Copper Alloys—Technical Information for Product Designers" has been prepared for guidance in selecting copper and copper alloys and for comparing their chemical and physical properties. The 54-page booklet is obtainable from Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

"Arc Welding Inspection Chart" pictures actual specimens of various results obtained in making fillet and butt welds and describes briefly the appearance and characteristics of proper and improper weld beads, with a brief description of the conditions under which each was made. The two-color, 23 x 35-in. chart is made available to inspectors, operators and others concerned with welding by the Lincoln Electric Co., Coit and Kirby Aves., Cleveland, Ohio.

Dry Batteries—How a dry cell produces electricity, reactions, characteristics, materials, and construction of dry cells are covered in a 46-page booklet "The Inside Story of Dry Batteries" obtainable from National Carbon Co., 30 East 42d St., New York 17, N. Y.; one copy to an applicant.

Air Circuit Breakers—For calculating the size of the 600-volt air circuit breakers for industrial substation applications, a slide rule has been based on standard A.I.E.E. formulas for determining short-circuit currents, taking into consideration necessary factors such as motor load and d.c. component. It can be used also to check breakers on any system. The "Unit-Sub Rule" is obtainable from Allis-Chalmers Mfg. Co., Wilwaukee, Wis.

Batteries—Handbook for engineers engaged in the application of switchgear contains data and covers subjects such as types, methods of operation, selection, maintenance, charging equipment, and racks for batteries. Bulletin 206, "Exide Batteries For Control Bus Operation," is available from Electric Storage Battery Co., 19th St. and Allegheny Ave., Philadelphia 32, Pa.

Plastics—Prepared for the non-technical man, a 24-page booklet provides a chart for plastic possibilities, describes and illustrates thermosetting and thermoplastic types, and contains properties of laminated Insurok. The publication "Facts About Plastics, Molded and Laminated" is available from the Richardson Company, Department 100, Melrose Park, Ill., when request is sent on your company's letterhead.

"Electronic Control, Fundamentals and Applications" covers principles of electronic tubes and their operation, lists functions of eight widely used industrial-type tubes, describes and illustrates applications for rectification, resistance welding, timing, and processing applications, as well as photoelectric installations. Bulletin GEA-4126 is issued by General Electric Co., Schenectady, N. Y.

Ball Bearings—The 1944 edition of "Interchangeable Ball Bearings for Replacement" contains a list of ten competitive makes of ball bearings and corresponding New Departure numbers, as well as New Departure bearing dimensional tolerances, meaning of prefixes and suffixes for each make of bearing, comparative bearing type and series numbering systems, and an interpretation of New Departure bearing numbers. A copy of Booklet R may be had from the Advertising Department, New Departure Division of General Motors, Bristol, Conn.

ALONG THE RIGHT-OF-WAY WITH

# HIGHWAY

## HIGHWAY EARTH BORING *Machines*

★ That tomorrow for which we are all working on the home front will see methods of a modern nature adopted to greater extent than ever before. Among them will be the mechanized method for hole digging. America's hurried and successful operations in the past few years have been a great instructor in the benefits that accrue to all as we put more and more modern equipment in the hands of workers.

True, in the past, utilities have to a wide extent recognized the many advantages HIGHWAY Earth Boring Machines have offered. Thousands upon thousands of holes have been dug by this ingenious method, through frost, shale, rock, hardpan, gumbo, sand, gravel, in swamps, and on hillsides.

This organization, with more experience behind it and with even better facilities than ever before, will be at your service when that tomorrow comes to give you the most advanced method for "boring the hole and setting the pole."

**HIGHWAY TRAILER COMPANY**

MANUFACTURERS OF

TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

*General Offices*

EDGERTON, WIS., U. S. A.

# NEWS ABOUT PEOPLE

## Staff Changes Announced by Boston Edison

James A. Galvin has been appointed acting publicity director in place of James V. Madonald, now in U. S. Navy service. Mr. Galvin has been with the company since 1921, and for the past five years has been assistant to John J. Buckley, superintendent of the public relations department. He will continue in the latter position. Melvin H. Brooks, since 1936 in the claim division and for 17 years before that in the transmission and distribution department, has been named assistant head of the former division. He joined the company in 1919.

Thomas E. Nolan, who entered the company's service in 1920 and has been active in its steam plant operations, has been made head of the steam division at the new Mystic station in Everett, Francis H. Danolds becoming assistant head af that division. Mr. Danolds became an Edison man in 1911. Edwin C. Quinn, in the production department since beginning Edison employment in 1918, has been named assistant head of the steam division, Charles Leavitt Edgar station, North Weymouth, succeeding the late W. A. Reynolds. Lawrence B. Howarth, with Boston Edison since 1925 in the standardizing and testing laboratory and then with the production department, has been named assistant head of the southeastern division with headquarters at Roslindale. He replaces E. J. Antonia, on military leave of absence.

•

▶ J. HAYWARD HARLOW has retired from the Philadelphia Electric Co. after more than 21 years of continuous service with that utility and its Maryland subsidiaries. About 1902 Mr. Harlow became interested in engineering projects on the lower Susquehanna River and made many studies on power sites. In 1908 when the Susquehanna Power Co. was formed, he continued such work with that company for a few years. From 1911 to 1922 he was president and general manager of the Havre de Grace Electric Co., when he became permanently associated with the Susquehanna Power Co. as engineer. Upon completion of the Conowingo plant, he joined the Philadelphia Electric Co., real estate department. In 1937 he was transferred to the Susquehanna Electric Co., Conowingo hydro plant, as property agent.

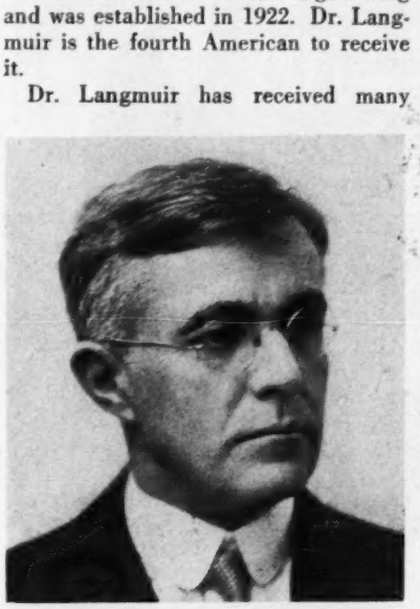
•

## Dr. Langmuir Awarded Faraday Medal

Dr. Irving Langmuir, associate director of the General Electric Research Laboratory, has been awarded the Faraday Medal of the Institution of Electrical Engineers in London, according to a radiogram he has received from Stanley Angwin, president of the Institution. Plans for its actual presentation will be made later.

The medal, one of the highest honors in its field, is given for world-wide services to electric science and engineering and was established in 1922. Dr. Langmuir is the fourth American to receive it.

Dr. Langmuir has received many



other outstanding awards, chief among them being the Nobel Prize in 1932 for his work on the absorption and orientation of molecules at surfaces and the mechanism of gas reactions at the surface of tungsten. In 1917 he received the Hughes Medal of the Royal Society, in 1921 the Rumford Medal of the American Academy of Arts and Sciences, in 1928 the Perkin Medal of the American section of the Society of Chemical Industries, the Franklin Medal of the Franklin Institute in 1934 and many others.

•

## Central Power & Light Names New Managers

E. L. Park, W. H. Cole and L. E. Van Horn have been appointed managers of the Central Power & Light Co. at Mercedes, Kenedy and Hebbronville, Tex., respectively.

Mr. Park, who has been manager at Kenedy for the past 17 years, was transferred to Mercedes to replace J. A. Slaughter. Mr. Slaughter is now in charge of the CPL office at Eagle Pass. Mr. Cole moved over from Hebbronville, where he had served as manager for ten years, to fill the Kenedy position. Mr. Van Horn, the new Hebbronville manager, has been transferred from Laredo. He was district commercial manager there.

All three men have had long service records with CPL.

•

▶ AUSTIN D. BARNEY, vice-president and general counsel of the Hartford (Conn.) Electric Light Co., has been elected a director of that utility.

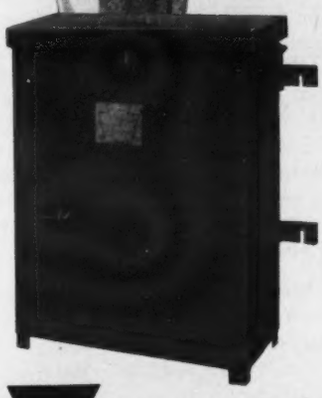
▶ W. J. DWYER, for the past three years assistant sales manager of the Triangle Conduit & Cable Co., Inc., New Brunswick, N. J., has been appointed sales manager. Mr. Dwyer has been associated with the company for the past 15 years.

▶ WILLIAM VON PHUL was the guest of honor at a dinner given last week in the Waldorf-Astoria Hotel, New York, by the board of directors of Ford, Bacon & Davis, Inc., following his retirement as chairman of the company's executive committee. Mr. von Phul was president of the organization from 1921 to 1942 when he was succeeded in that office by James F. Towers.

▶ WILLIAM M. HICKEY, president of United Corporation, has been elected a director of the Columbia Gas & Electric Corp. He is also a director of the United Gas Improvement Co., Public Service Corp. of New Jersey and the Brockton (Mass.) Gas Light Co.

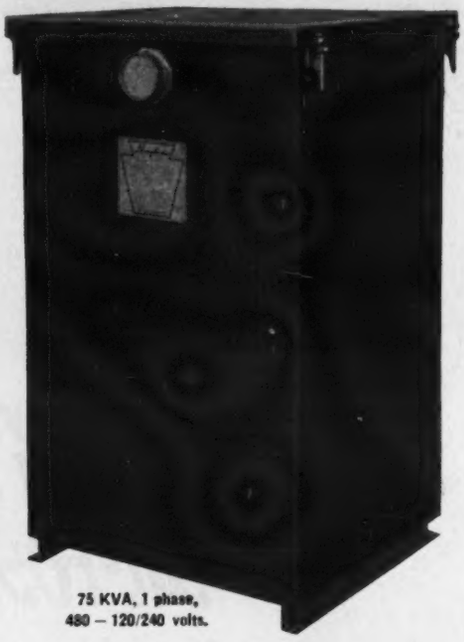
▶ E. W. ROCKWELL, senior engineer in the electrical division for the Metropolitan Water District of Southern California, assumed duties on Feb. 1 as resident engineer of the Colorado River commission for Nevada, to serve a minimum of three months. Mr. Rockwell, who was highly recommended by the

# "Sure, we build DRY-TYPE TRANSFORMERS ... THOUSANDS OF 'EM!"



5 KVA, 3 phase, 460 – 230 volts.

50 KVA, 3 phase, 460 – 208Y/120 volts.

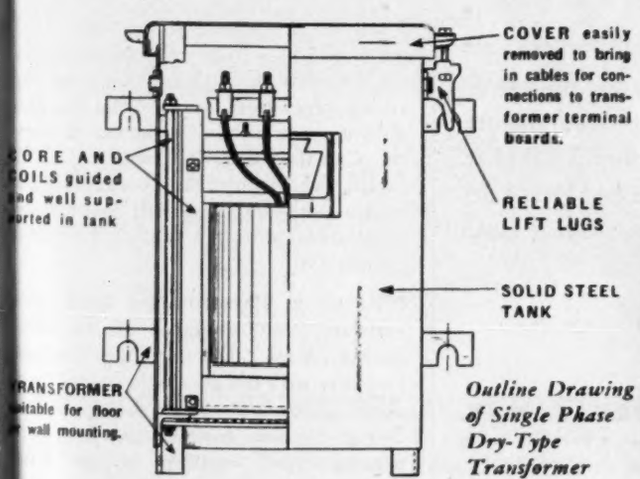


75 KVA, 1 phase, 480 – 120/240 volts.

Pennsylvania TRANSFORMERS

Dry-Type Transformers are usually located indoors near the load centers where there is a great deal of work and activity. It is essential, therefore, that the live parts of the transformer be protected from bars, tools and other metal objects which are moved around the plant. Furthermore, the core and coils of the transformer must be protected from water falling on the transformer through a leaky roof or from a sweating ceiling.

These were some of the problems given careful consideration by our Engineers in designing a Dry-Type Transformer which has acquired an enviable reputation for its safe and efficient operation.


COVER easily removed to bring in cables for connections to transformer terminal boards.
RELIABLE LIFT LUGS
SOLID STEEL TANK
ORE AND OILS guided and well supported in tank
RANSFORMER suitable for floor or wall mounting.

*Outline Drawing of Single Phase Dry-Type Transformer*

## SAFE:

A steel plate tank completely encloses the live parts of the transformer and protects them from external injuries. Tools or metal rods carried through a plant cannot penetrate the tank and come into contact with the live parts of the transformer. This is protection for the workmen as well as for the transformer.

## DRIP-PROOF CONSTRUCTION:

The transformer cover extends beyond the walls of the tank and provides a drip-proof duct around the cover for the hot air to escape. Water falling on the transformer cannot enter the tank and injure the coils.

## EFFICIENT COOLING:

Cool air enters through a screen underneath the tank. The air circulates through vertical ducts in the coil, and escapes at the top of the tank, underneath the cover, thereby providing an efficient cooling system.

## VERTICAL COOLING SURFACES:

All cooling surfaces in the coils are vertical. There are no horizontal surfaces to collect dust and hinder the proper cooling of the transformer.

**Pennsylvania**
**TRANSFORMER COMPANY**
PITTSBURGH, PENNSYLVANIA

will help you get full benefit of the advantages of SIL-FOS and EASY-FLO

— in making electrical connections
— in brazing bus bars and switchboards
— in structural work on equipment
— in electrical repairs

On all of this work the two low-temperature silver brazing alloys, SIL-FOS and EASY-FLO, are now widely used because of the high strength, high conductivity and corrosion resistant joints they make—and the speed, reliability and economy with which they make them.

The wall chart tells in easy-to-understand terms the right way to use SIL-FOS and EASY-FLO to get full benefit of these advantages. We'll be glad to send you one or more copies on request. Ask also for BULLETIN 12-A. It gives full details about SIL-FOS and EASY-FLO advantages and a lot of useful information about metal joining. Write today.

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82 FULTON ST., NEW YORK 7, N. Y.
Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal. • Providence, R. I. • Toronto, Canada
Agents in Principal Cities

United States Bureau of Reclamation as familiar with power problems in connection with the Boulder Dam project, has had 24 years experience as an electrical engineer in southern California. He is a member of the American Institute of Electrical Engineers.

▶ JACKSON T. MURPHY, chief statistician of the Jersey Central Power & Light Co., Asbury Park, N. J., has been elected assistant secretary of the company. Mr. Murphy has had 28 years of service with the utility, starting in Red Bank as chief clerk in the power station. He was transferred to the general office in 1925 where he headed the statistical department.

▶ STEPHEN TERPAK of the high voltage bushing engineering division, Pittsfield (Mass.) works of General Electric, has been appointed head of the design section of that division. His service with the company began in 1924. BENJAMIN BOWERS has been made head of the bushing design group, and LESTER PHILLIPS head of the cable accessories and design group. Messrs. Bowers and Phillips became identified with the General Electric Company in 1923.

▶ IRA ROWELL, San Francisco attorney, has been appointed a member of the California State Railroad Commission by Governor Earl Warren. Mr. Rowell, who was connected with the commission from 1927 to 1943 as examiner, assistant attorney, and latterly as chief counsel, fills the vacancy caused by the death of Carl C. Baker.

▶ GEORGE U. PARKS, assistant general manager, Montaup Electric Co., Somerset, Mass., since its establishment in 1925, has been appointed general manager. LOUIS F. EATON, lately assistant to the vice-president in charge of electrical operation and sales, Blackstone Valley Gas & Electric Co., Pawtucket, R. I., and previously with the Stone & Webster Service Corp., Boston, and the Brockton (Mass.) Edison Co., has been named assistant general manager at Montaup.

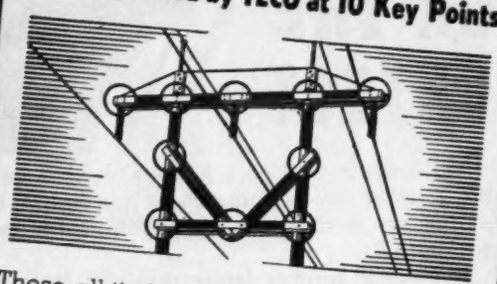
▶ H. H. COURTRIGHT, president and manager of the Valley Electrical Supply Co., Fresno, Calif., has assumed the added duties of manager of the San Joaquin division of the Pacific Gas & Electric Co. Mr. Courtright succeeds E. P. Smith, who is retiring because of ill health. Mr. Courtright will continue his association with the Valley Electrical Supply Co.

▶ RALPH F. PRESCOTT, for some years assistant chief engineer of the Cambridge (Mass.) Electric Light Co., and formerly with the generating plant engineering division of the New England Power System, Boston, has been appointed chief engineer of the West

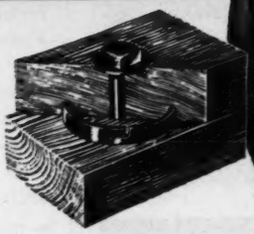
# TIMBER H-POLES
## *For Electric*
## TRANSMISSION

Sketched from an installation in New York State, erected by the U. S. Engineers and prefabricated by the American Crossarm and Conduit Company, Chicago.

**Ring-Connected by TECO at 10 Key Points**



These all-timber H-Poles use TECO Timber Connectors at 10 key points to provide greater strength and rigidity. They are designed to withstand the high stresses caused by broken conductors in icy weather. Secure maximum strength in service at lowest cost by using TECO Connected Wooden H-Poles. Let our engineering department assist you on your next transmission line design. *Write for our literature today.*



***The TECO Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.***

**TIMBER ENGINEERING COMPANY**
NATIONAL MANUFACTURERS OF TECO TIMBER CONNECTORS AND TOOLS
WASHINGTON CHICAGO MINNEAPOLIS NEW ORLEANS PORTLAND

# HEY MAC— GET IN ON THIS!

## SERVICE MEN...KEEP SENDING THOSE LETTERS!

"Bill Halligan says that all the contest entries he's received so far have been *swell*—he wants more letters tellin' about actual experiences with *all* types of Radio Communications equipment built by Hallicrafters including the SCR-299!"

## RULES FOR THE CONTEST

**Hallicrafters will give $100.00 for the best letter received during each of the five months of November, December, January, February and March. (Deadline: Midnite, the last day of each month.)**

**For every serious letter received Hallicrafters will send $1.00 so even if you do not win a big prize your time will not be in vain.**

**Your letter will become the property of Hallicrafters and they will have the right to reproduce it in a Hallicrafters advertisement. Write as many letters as you wish. V-Mail letters will do.**

MILITARY REGULATIONS PROHIBIT THE PUBLICATION OF WINNERS' NAMES AND PHOTOS AT PRESENT . . . MONTHLY WINNERS WILL BE NOTIFIED IMMEDIATELY UPON JUDGING

BUY MORE BONDS!

**hallicrafters RADIO**

THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.


Water Street station of the Taunton (Mass.) Municipal Lighting Plant. FREEMAN L. TYLER, lately chief engineer at Taunton, has relinquished the position as the result of impaired health due to an accident, but will continue with the Taunton plant in another capacity following a vacation.

•

## I. T. & T. Appoints Four New Vice-Presidents

Announcement has been made by the International Telephone & Telegraph Corp. of the appointment of four new vice-presidents and four second vice-presidents.

The new vice-presidents are H. C. Roemer, vice-president and comptroller of Federal Telephone & Radio Corp., a manufacturing affiliate of I. T. & T.; W. H. Freng, assistant general attorney, who has also been appointed solicitor; Charles D. Hilles, secretary of the corporation, and Francis White, vice-president of the International Standard Electric Corp., another I. T. & T. affiliate.

Second vice-presidents appointed are F. F. Davis, H. H. Buttner, G. A. Ogilvie and Leonard Jacob II.

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▶ James H. Powell, residential lighting supervisor of the Jersey Central Power & Light Co., Asbury Park, N. J., has relinquished his association with that utility to become a lighting engineer with the lamp division of General Electric Co. in New York. Mr. Powell has been connected with the New Jersey utility for 14 years, serving previously with the L. E. Myers Construction Co.

▶ R. H. DAVIES has been appointed welding engineering representative of the Lincoln Electric Co. in Washington, D. C. Mr. Davies has had wide experience in the industrial engineering field. After receiving his education at the University of Minnesota, he was employed by the Lockheed Aircraft Corp. Later he became connected with Northrop Aircraft, Inc., and more recently with Henry J. Kaiser.

▶ EDMOND M. DELORAINE, general director of the laboratories division of the Federal Telephone & Radio Corp., manufacturing affiliate of the International Telephone & Telegraph Corp., has been elected a member of the I. T. & T. board of directors. He has been associated closely with the corporation's research development since 1925.

▶ WILLIAM O. WILSON of Evanston, Ill., has been appointed a commercial vice-president of Worthington Pump & Machinery Corp. In his new capacity Mr. Wilson will be responsible for general supervision and direction of all

# *Superior varnishing characteristics*

1. complete impregnation
2. higher dielectric
3. with less varnish build-up
4. fewer varnish dips
5. superior finish

● These definite improvements in the results obtained with the new Kappa Cellulose Acetate Rayon Tapes, when varnish-impregnated by standard methods, have been proved both by authoritative impartial laboratory tests and by the experience of many leading electrical manufacturers now using Kappa Tapes in regular production.

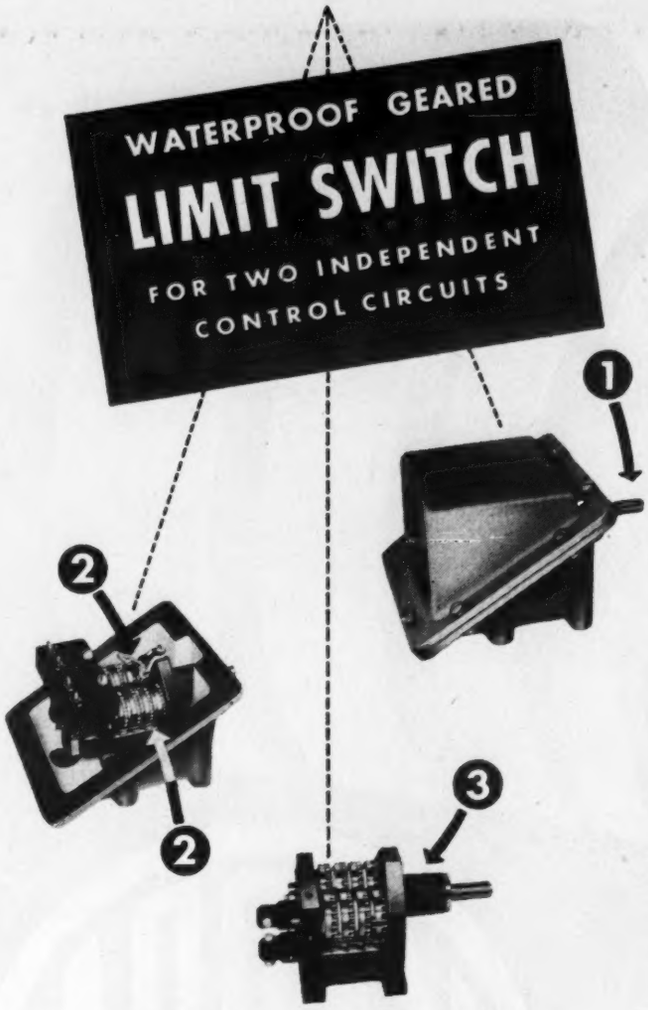
The KAPPA TECHNICAL BULLETIN gives in detail the results of tests covering both physical and electrical properties of varnished samples, together with specifications and prices. Ask for your copy of this bulletin, also for long length test samples of Kappa Tape in the widths and thicknesses you use. Kappa Tapes are IMMEDIATELY AVAILABLE in standard widths and consistent mil thicknesses . . . including 3, 5, 7, and 10 mil. Write to The Wm. E. Wright & Sons Company, Industrial Textile Division Box 1000, West Warren, Mass.

*Complete test and Technical Data and prices in this new Bulletin. Free on request.*

CELLULOSE-ACETATE RAYON

## COIL-WINDING TAPES

*The Wright tape for every winding..* KAPPA




Suitable for handling normal control currents. Adjustable between 1 and 3333 revolutions—for speeds up to 1200 rpm.

1. *Only this shaft is attached to moving machinery—easy to get to—easy to attach and detach.*
2. *Only top of housing is removed to set—no need to disturb mechanical or electric connection. Wiring is easy, too—requires no disconnecting of mechanical connection or setting.*
3. *Working unit is simple, self-contained and easily removable.*

BAYARD

The third star of continued achievement has now been added to the Bayard Navy "E" Pennant.

M. L. BAYARD & CO., Inc. • ENGINEERS • MACHINISTS • PHILADELPHIA


of Worthington's commercial activities in the Chicago, St. Louis, Kansas City and St. Paul district office territories, with his headquarters at the Chicago district office. Mr. Wilson has been with Worthington Pump & Machinery Corp. and its predecessor companies since 1898, except for a two-year period starting in 1911 when he was employed as construction engineer for American Water Works & Guarantee Co. In 1919 he was appointed district manager at Pittsburgh, and in 1928 was transferred to Chicago as district manager. Since 1937 he has been manager of Worthington's Midwest district, comprising the Chicago, St. Louis, Kansas City and St. Paul district office territories.

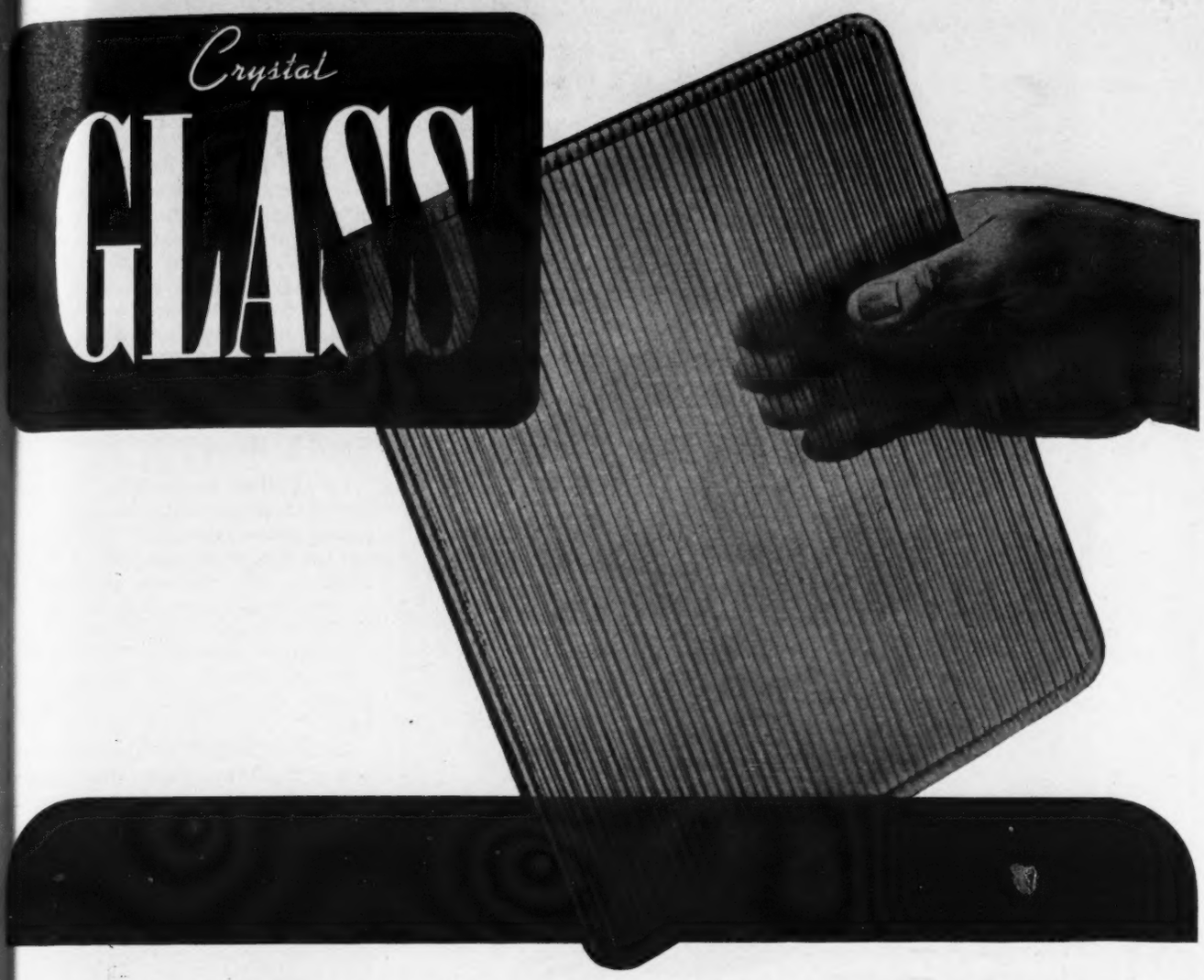
▶ R. C. HARDY has been appointed district manager of General Electric Co.'s central station division, Cleveland, to succeed the late Erle F. Whitney, who had been manager for 14 years. Mr. Hardy joined General Electric's test department, Schenectady, in 1922, and later was transferred to the company's central station engineering department. In 1928 he was transferred to the east central district engineering division, Cleveland, and three years later he was assigned to sales. In 1936 he was appointed assistant to the district manager, central station division, serving in this capacity until his new appointment.

▶ JACK H. FROHLICH, widely known for many years in the household appliance field, has returned to Norge division of Borg-Warner Corp. in Detroit as promotion manager. Mr. Frohlich returns to Norge from Indianapolis where he served as district manager of the War Production Board. Mr. Frohlich first joined Norge in 1931 when he organized and directed the company's first big national promotional program.

▶ A. CARL BREDAHL, chief of the mechanical-electrical-utilities division of the Federal Public Housing Authority since 1934, has been appointed technical director of the Westinghouse Better Homes Department. Mr. Bredahl will be responsible for the development of all technical phases of the department in such services as kitchen and laundry planning, wiring layouts and lighting suggestions. The better homes department was organized recently to co-ordinate the activities of Westinghouse in the housing of war workers and, ultimately, in developing the company's post-war housing markets. In his governmental position, Mr. Bredahl occupied an important role in providing homes for war workers. Among his other duties, he was responsible for establishing the design standards of mechanical and electrical installations for the pre-war low-rent housing projects and later war housing projects. A native of Copenhagen, Denmark, Mr. Bre-

Crystal

# GLASS



**The best available material for scientifically-correct illumination**
**Because it has *all* the qualities specified by the Electrical Engineer:—**

- **IT IS CRYSTAL-CLEAR** (will not discolor)
- **IT IS WATER REPELLENT** (and stays that way)
- **IT IS SCRATCH-RESISTANT** (impervious to abrasion)
- **IT WILL NOT WARP**—even at high temperatures

**CONSULT HOLOPHANE ENGINEERS** for authoritative recommendations as to safe, efficient permanent lighting. Specifications based on individual manufacturing conditions are available without charge. These services are offered not in competition with those of architects or engineers, but only to supplement their advice.

*Write for "Guide to Relighting" and timely bulletins which present comprehensive data on every phase of industrial lighting. Available without charge.*

**HOLOPHANE** COMPANY, INC.. *Lighting Authorities—Since 1898*
342 MADISON AVENUE, NEW YORK • Holophane Co., Ltd., 385 Yonge St., Toronto, Can.

*Because good lighting and the saving of manpower are so unmistakingly linked we have contributed to and are cooperating with the WAR PRODUCTION FUND TO CONSERVE MANPOWER*

STEEL—and steel alone—possesses the rugged strength required for guying a pole structure . . . for steel can take the punishment encountered both in construction and in service.

All the strength and ruggedness inherent in steel is developed to the fullest extent in *Crapo* Galvanized Steel Strand. Each size and grade is manufactured from steel of selected analysis and processed from start to finish to do the job for which it is intended.

The heavy, ductile, tightly-bonded zinc coating—applied by the famous *Crapo* Galvanizing Process—provides lasting protection against corrosion; extends the life of the strand beyond the normal period of replacement.

There is a size and grade of *Crapo* Galvanized Steel Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you, or write for further information!

**INDIANA STEEL & WIRE COMPANY . . . . . MUNCIE, INDIANA**

**Crapo GALVANIZED STEEL STRAND**

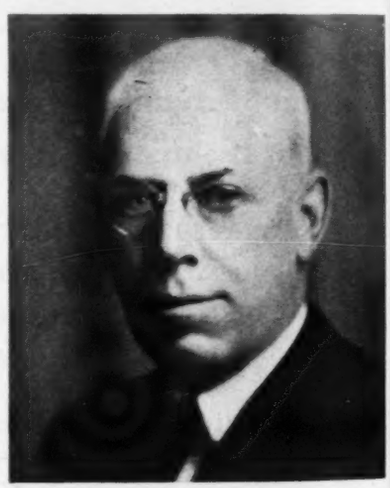

dahl came to the United States and studied electrical engineering at Columbia University, returning to Europe in 1921 for a year to pursue his engineering education at the Polytechnic Institute in Oslo, Norway. Back in America, he joined the New York architectural firm of Warren & Wetmore, engaging in electrical design work. In 1930 he and two other Warren & Wetmore colleagues organized the consulting engineering firm of E. I. Daugherty & Co. of New York. He stayed as a member of that firm until he entered government service in 1934.

## OBITUARY

### Fred L. Hunt

Fred L. Hunt, 64, operating vice-president of the Western Massachusetts Companies system, Greenfield, died in that city on Feb. 8. He was born in Delta, Iowa, in 1879, and was graduated in electrical engineering from the University of Nebraska in 1902. He entered General Electric's testing department in Schenectady and in 1905 was appointed assistant district engineer at the Boston office.

In 1913 Mr. Hunt became chief engineer of the Turners Falls (Mass.) Power & Electric Co., and general manager of the Connecticut River Conservation Co. He was appointed director of economics and engineering for the Western Massachusetts Companies in 1927 and ten



years later became vice-president. Mr. Hunt rendered services of high distinction in the development and co-ordination of these properties into a single system supplying important urban and rural areas in the central Connecticut Valley from Springfield north, and was influential in their relationships with adjoining utility systems including the Connecticut Valley Power Exchange.

He was a past-president of the Engineering Society of Western Massachusetts and had been chairman of the A.I.E.E. committees on protective devices and lightning arresters, and of a

former N.E.L.A. committee on power-factor improvement.

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▶ WELDON O. HAMPTON, chief design engineer for the Delta-Star Electric Co., Chicago, Ill., died of pneumonia on Feb. 9 after a short illness. Mr. Hampton, who was 42 years of age, had been continuously associated with Delta-Star since 1922. Starting as a draftsman, he advanced by successive steps and became chief design engineer in 1941. Mr. Hampton was active in the affairs of the American Institute of Electrical Engineers.

▶ DANIEL B. TWEED, superintendent of the Salisbury district of the Duke Power Co., died on Feb. 5 at Salisbury, N. C., as a result of a heart attack. He was 42 years of age. A native of Jonesville, S. C., Mr. Tweed had been with the Duke Power Co. for 22 years.

▶ WALFRED A. PETERSON, president of the Continental Electric Co., Newark, N. J., died in that city on Feb. 7 after a brief illness. He was 63 years of age. Born in Fjaras, Sweden, Dr. Peterson came to this country in 1896.

▶ GEORGE L. DUMBAULD, vice-president and treasurer of the Blaw-Knox Co. since 1936, died on February 3 at his home near Pittsburgh at the age of 61. He had been associated with the company for 24 years. He joined the Blaw-Knox organization as controller in 1920, was elected a director in 1929, treasurer in 1930 and a vice-president in 1936.

▶ HARRY E. MOORE, secretary-manager of the Electric Association of Kansas City (Mo.) since 1942, died on Jan. 24 at the age of 51. Before joining the Electric Association, Mr. Moore was connected with the Kansas City Power & Light Co. for twelve years, serving as a salesman in the radio department, manager of the radio and refrigerator department and as assistant to the vice-president in charge of merchandising. In 1937 Mr. Moore left the Kansas City utility to become manager of the appliance department of the Katz Drug Co., later returning to the utility company.

▶ CHARLES P. RHINE, division maintenance engineer for the San Joaquin power division of Pacific Gas & Electric Co., died on January 17 at the age of 60 in Berkeley, Calif. Beginning his career with the Southern Pacific Co. after receiving a degree in electrical engineering from Purdue in 1909, Mr. Rhine transferred to the San Joaquin Light & Power Corp. in 1918 and filled various engineering positions with them and P.G.&E. until his death. He was a member of the Pacific Coast Electrical Association.


PERMAFLECTORS

Peak Lighting AT LOW COST with NEW 200 watt FLOODLIGHT

SPECIFICATIONS

Height overall, 12½". Length, front to back, 11¼" Lens, 8⅜" in diameter. Metal finish, dull olive drab. Net weight, 6½ lbs.

UNIVERSAL ADJUSTMENT

Floodlight is easily, quickly positioned to direct the light where wanted – 250° swing vertically, 360° horizontally – simply by adjusting wing bolts on bracket and base.

Projecting a full pattern of light on an area of 2500 sq. ft., at a distance of 50 ft., the new ST-200 Permaflector Floodlight meets the demand of low-wattage users for highly efficient lighting of work areas.

Rugged in construction, incorporating features found only in larger, higher-priced floodlights; highly resistant to shock and vibration; weather-proof and corrosion-resistant; equipped with the famous silver-mirrored-glass Permaflector; steel protective housing; heat-resisting lens, (easily removable for maintenance.)

Takes standard 200-watt, PS 30, Medium Base Incandescent Lamp – 110-120 Volt Service.

Low in cost! Inquire of your jobber or write direct.

PITTSBURGH REFLECTOR CO.

MANUFACTURERS OF LIGHTING EQUIPMENT AND THE FAMOUS Permaflectors
OLIVER BLDG. PITTSBURGH, PENNA.

Please rush complete data on small-wattage PERMAFLECTOR Floodlight ST-200 – *EW-2-44*

NAME.....

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CITY..... STATE.....

# MANUFACTURING-MARKETS

## Westinghouse Profit Totals $22,355,300

Westinghouse Electric & Manufacturing Co. reports a net income of $22,355,300 in the preliminary annual statement just issued, after voluntary price reductions in line with the 1942 renegotiation agreement and provision of $82,008,429 for federal taxes on income. The income is equal, under the participating provisions of the shares, to $6.97 a share on the combined 79,974 shares of $3.50 preferred and 3,126,581 shares of common stock. No reserves for renegotiation were set up by the company in 1943, since the reductions already made are considered sufficient. The net income in 1942 amounted to $17,366,841, or $5.41 a share on the combined stocks.

Net sales of $714,305,303 billed last year exceeded the 1942 volume by 47 percent, "after voluntary price reduction in line with our renegotiation agreement in 1942," the report states. Although $320,000,000 of war orders were cancelled last year, new high records in production were set by the company, A. W. Robertson, chairman, pointed out.

New business placed by the company last year aggregated $958,967,057 and the backlog of unfilled orders at the year end totaled $885,708,065.

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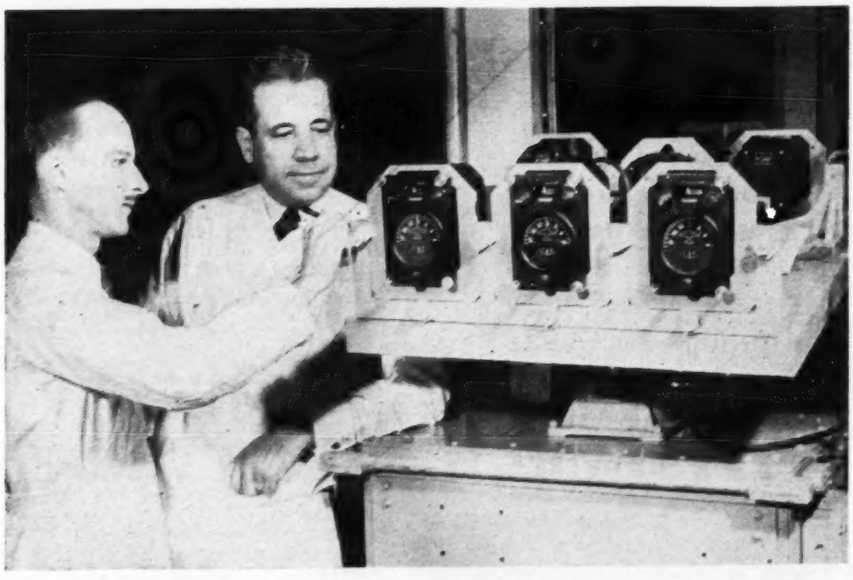
## Air Conditioning Expansion Forecast

Air-conditioning plants equipped to provide year-round controlled temperatures in virtually every home in the nation will function almost immediately after the war, Louis Ruthenberg, president of Servel, Inc., recently stated.

Speaking at the winter meeting of the Industrial Research Institute, an affiliate of the National Research Council, at the Westchester Country Club, Rye, N. Y., Mr. Ruthenberg said: "Future homes will be maintained at constant comfort levels throughout the year. Summer air conditioning will be no more unusual than central heating and modern plumbing."

Mr. Ruthenberg praised industrial research methods as having contributed much toward development of business organizations and declared that research could be utilized effectively in the solution of many problems which must be met if human welfare is to be advanced. He assailed excessive government taxation of business.



**ELECTRICAL GYROSCOPIC INSTRUMENTS**—Two types of gyroscopes used in an automatic pilot are described by H. M. Witherow and Albert Hansen, Jr., of the General Electric Co. at the A.I.E.E. in New York. Because tiny particles of grit drift for miles above sandy deserts, moving parts must be sealed in a case.

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## Reliance Issues Report to Employees

In recognition of today's paper shortage and the growing use of "short forms" to ease the situation, the Reliance Electric & Engineering Co., Cleveland, Ohio, has condensed its 1943 report to stockholders into an illustrated four-page summary for employees, entitled "How Our Income was Distributed."

Front page of this abbreviated summary carries an illustration of the year's distribution of income dollars, plied in stacks to represent graphically the proportionate expenditures for materials, wages, taxes, dividends, depreciation, postwar provision and amount reinvested in the business. Each stack is labeled with the exact amount of dollars involved.

On one of the two inside pages detailed descriptions of expenditures are carried in a table of income distribution. Two pages are devoted to a letter from Clarence L. Collens, Reliance president, giving a further explanation of some of the figures used and outlining the company's post-war prospects as they appear at this moment to the management.

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## Change Dividend Practice

Directors of the Aluminum Co. of America have authorized a 50-cent dividend on the common stock for payment on March 10. Gordon W. Cameron, treasurer, states that prior to the recent three-for-one split-up of common stock the company had been paying $1 a share in each of the first three quarters of the year and $3 in the fourth quarter, making a total of $6 for the year. The company's intention now, he states, is to change the practice of unequal quarterly dividends by payment of 50 cents in each quarter of the year, or the equivalent of $1.50 quarterly on the old common stock.

•

## Leases Ordnance Unit

Western Electric Co. has announced that it has leased Area 2 of the Eau Claire ordnance plant at Eau Claire, Wis., to provide additional manufacturing facilities.

BEN HUR TRAILER ENGINEERING applied to your post-war plans may show you, too, new uses for handy trailer units—to move tools to the job, to mount vital machine units, carry supplies and materials, or for mobile service units.

Take advantage of Ben-Hur's experience in trailer design and engineering to help YOU to new progress in post-war business planning.

Write for our data sheet to aid your post-war planning.

Awarded Army-Navy "E" for excellence of war production.

**BEN-HUR MANUFACTURING CO.**

634 East Keefe Ave., Milwaukee 12, Wis.

**BEN-HUR**

**INDUSTRIAL TRAILERS**


## Manufacturers Issue Earnings Reports

Statements of earnings have recently been issued by the following manufacturers:

ROME CABLE—December quarter, net profit, $125,069, subject to year-end and war emergency adjustments, equaled 66 cents a share and compared with $97,546 or 51 cents a share, for three months to Dec. 31, 1942. Nine months to Dec. 31: net profit, after $1,513,569 taxes and $125,000 contingency reserve, was $426,112, equal to $2.24 a share, against $215,064, or $1.12 a share, for nine months to Dec. 31, 1942, when $503,516 was deducted for taxes.

OHIO BRASS—Including wholly owned subsidiaries, for 1943, net profit, $577,889 or $1.66 a common share, against $661,652 or $1.90 a common share the year before. Full depreciation taken during the year amounted to $222,043. The reserve for taxes includes an amount of $50,700, which represents an estimated post-war refund of federal excess profits tax and has been charged against the year's operations.

JOHNS-MANVILLE—Net income, 1943, $4,655,280, after all charges and taxes and including post-war refunds of excess profits taxes, equal to $5.27 a common share. This compares with net income of $5,570,192, or $6.35 a common share, for 1942. Sales for 1943 were $107,418,305, compared with $108,021,383 in 1942, a decrease of $603,078.

•

## Physicist Cites Electric Industry for Research

Physical science can provide a tonic for the ill of unemployment in the post-war world, Dr. Albert W. Hull, assistant director of the General Electric research laboratory, declared recently.

Speaking as retiring president of the American Physical Society, meeting at Columbia University, he said that "this tonic is new products. New products are resistant to depression psychology, and experience has shown that they can be sold when old products cannot. In this way physicists can contribute to the all-important job situation."

As outstanding examples of the need of physical research he cited food and shelter. In contrast, he mentioned the electric industry, which, as the result of research, has reduced the cost of electric power and lamps, and has produced such new products as X-rays, radio, refrigerators, etc., which gave employment to hundreds of thousands.

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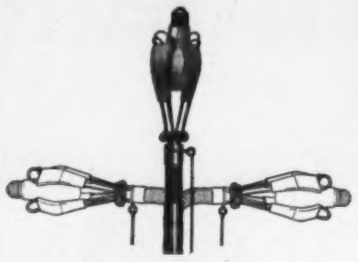
## Instrument Repair Course

A new industrial instrument maintenance and repair course was started on February 1 by the training school division, Brown Instrument Co., Philadelphia, Pa. The new classes will extend to April 26.


**MATTHEWS HOLDFAST LAMP CHANGERS**



Removes and replaces lamps in high places, such as ceilings, side walls, electric signs, etc. Like a human hand on the end of a wooden pole. Saves time and prevents ladder accidents.

To remove or replace lamps from side walls or at an angle, pull cord attached to the swivelled ring. This bends the wristlike coil spring so that the Changer will work just as well at a right angle to the rotating pole as in vertical position.

Shipping weight each, 1 pound.

No. 2

For 50-Watt Rough Service, 15 to 100 Watt Mazda and other lamps up to 3 inches in diameter.

| No. 2 | Less Than 6 | 6 to 11 | 12 or More |
|---|---|---|---|
| Price Each | $5.00 | $4.75 | $4.50 |

No. 3

For 60 to 500 Watt Mazda Lamps and other large and odd shapes up to 5 inches in diameter.

| No. 3 | Less Than 6 | 6 to 11 | 12 or More |
|---|---|---|---|
| Price Each | $5.50 | $5.25 | $5.00 |

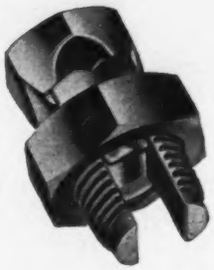
All Prices F.O.B. St. Louis, Mo.

Specially treated wood handles can be furnished in 6-foot sections at $3.75 per section including couplings.

*Your Electrical Supply Jobber Will Fill Your Order.*

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.

# RELIABLE Connectors



**Save Time**

by using solderless connectors with accurately fitting precision threads which insure easy, permanent installations.

**Save Copper**

by using these connectors which are good as new after being salvaged.

**EASY TO INSTALL LOW IN COST**

Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES


# Field Reports on Business

*Utility orders for system maintenance and repair continue steady, though at low levels. Demand for large motors has fallen off, but small motors continue active. New housing construction is being done on a large scale, with its accompanying requirements for wiring and lighting supplies.*

## NEW ENGLAND

Boston Edison has received government approval for the manufacture (G.E.) and delivery of a second 50,000-kw. steam turbine unit for the Mystic station. U. S. Rubber has leased a large one-story building from the Blood Locomotive Works, Nashua, N. H., and will install machinery for the production of war materials beginning about March 15; it is expected that 200 workers will be employed. More than 800 employees will be put to work in a new branch to be opened by the Hytron Co., Salem, Mass., at Lawrence. The outlook for increased sales in wiring supplies is brightened by recommendations for two large additions to veterans' hospitals in this region. In a bill now pending before Congress $310,000 is asked for Connecticut hospital facilities and $460,000 for the West Roxbury (Boston) group.

Bids tendered for Navy supplies last week were down sharply. Electric heaters are in demand; power distribution panelboards and small switches attracted proposals from Connecticut manufacturers. Rectifiers, fuses, trolley wire and electric cable for welders were among the items listed on schedules. There is considerable activity in small motorized machine tools needed for naval supply ships. Applications for the purchase of electrical supplies needed for the repair and replacement of farm and domestic appliances in northern New England areas are increasing at WPB centers and contractors are pressing vigorously for release of much-needed material. Two more DE type vessels were scheduled for launching Feb. 15, at the Bethlehem-Hingham shipyard.

## CHICAGO

War orders, including lend-lease, are keeping the output of electrical manufacturers in the Chicago area at near peak levels, according to current reports. Equipment and accessories for temporary power plants, foreign power and signal systems are prominent among the items being produced for foreign governments. Orders for utility system maintenance and repair are scattered and difficult to classify but continue fairly steady at low levels. There appears to be little change in the demand from this source. Bookings for industrial electrical apparatus for refineries, rubber plants, ammunition depots, etc., while down about 25 percent compared with last summer, steel far outweigh orders for utility maintenance and repair equipment.

Dealers in used electrical machinery, motors and generators report that the call for larger units, 100 hp. and up, is off about 50 percent from the peak demand of a year ago. Falling off in demand for large motors has been gradual but steady, and is currently off about 12 percent compared with the fourth quarter of 1943. Small motors, on the other hand, continue active reflecting inability to replace small domestic and industrial units with new as failure rates increase with age.

During the week ended Feb. 10, sixty-three Chicago area firms received 88 war contracts totaling over $6,600,000. Department store sales in Chicago for the week ended Feb. 5 showed no change compared with a year ago. For the nation the increase over the corresponding 1943 week was only 2 percent.

## NEW YORK

The shift to better grade merchandise by customers was evidenced last week in the New York metropolitan area in the sales rise of 7 percent for the main stores and a decrease of 4 percent in business done by basement sections. All over the second Federal Reserve District, sales in the department stores increased 6 percent over 1942 while inventories at the end of the year declined 8 percent, according to the report issued last week by the Federal Reserve Bank of New York. Tighter supply conditions on many lines were reflected as important departments had stock decreases under a year ago.

Civil engineering construction volume in continental U. S., according to the *Engineering News-Record*, totaled $23,151,000 for the week. This volume, not including construction by military engineers abroad, American contracts outside the country, and shipbuilding, is 35 percent lower than in the preceding week, and 67 percent lower than the total reported for the corresponding 1943 week. Private construction is 78 percent below a week ago, and 23 percent under a year ago. Public construction tops last week by 17 percent, but is 71 percent below the week in 1943.

Current week's construction brings 1944 volume to $215,192,000 for the six weeks of the year, a decrease of 43 percent from the $379,561,000 reported for the period in 1943. Private construction is 52 percent higher than in 1943.

## PACIFIC COAST

Considerable new housing construction is reported well distributed over the West Inland as well as along the coast. It includes a $3,303,754 award for 848 family dwelling units in Portland and Vancouver; 160 homes in Hollywood, costing $750,000; 403 single and duplex family residences in Inglewood, Los Angeles County, costing $1,500,000 and a tract of privately constructed homes in Seattle, costing $1,115,000. San Francisco reports 1,000 new homes assigned to various locations and with a better than average electrical standard.

WPB has granted priorities for 11-mile Deer Creek acqueduct from Provo River in Utah, estimated cost is $5,000,000, with completion scheduled for June, 1945.

Typical orders cover $20,000 of 1½ to 5 hp. motors; $25,000 of fractional horsepower motors for oil burners; $50,000 of sizes 15 to 250 hp. motors for installation in an oil refinery and several lighting jobs for various Inland army air fields of which $46,347 for La Junta, Colo., is typical.

The Navy has asked Congress to appropriate $130,000,000 for ship repair facilities along the Pacific Coast, major items being $39,000,000 for floating drydocks; $61,000,000 for their adjoining facilities; $10,000,000 additional for Hunters Point base near San Francisco and $26,000,000 as a reserve. These drydocks require a considerable electric wiring cable and auxiliary motor installation to be done by local firms in most cases.

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# Sales Opportunities

OREGON—Bonneville Power Administration, Portland, will make extensions in 115-kv. transmission line, including a crossing over Willamette River, using wood poles, with clearance of 75 ft. above low water. Permission has been secured and work is scheduled to be carried out at once.

VIRGINIA—General Chemical Co., 40 Rector St., New York, N. Y., has contracted with government for construction and operation of plant, comprising several buildings for processing, general production and miscellaneous service, with machinery and electrical equipment for large output. Cost estimated about $1,500,000, with financing by Defense Plant Corp. Proposed to carry out work at early date.

TENNESSEE—War Department, Washington, D. C., has authorized expansion in army air force station, including three additional one-story warehouses, with mechanical and electrical equipment. Cost estimated about $500,000. Project will be supervised by District Office of U. S. Engineers, Mobile, Ala.

OHIO—Baltimore & Ohio Railroad Co., Baltimore, Md., has plans under way for new coal-loading and handling dock on Black River, reported to cost over $1,000,000, with mechanical-handling and electrical equipment. It is understood that project will have a priority rating. Company also plans new ship docking pier and extensions in yard facilities, to cost in excess of $600,000.

UTAH—Navy Department, Washington, D. C., has authorized expansion in naval supply depot, including shops, warehouses and other industrial buildings, with mechanical and electrical equipment. Also barracks and other housing structures. Extensions will be made in electrical distribution system, power substation facilities and service connections. Entire project will cost about $995,000. Commanding officer at depot will supervise work.

TEXAS—Dow Magnesium Corp., Midland, Mich., subsidiary of Dow Chemical Co., same place, will make extensions in branch plant for increased capacity for government, with installation of additional machinery and electrical equipment. Cost estimated about $180,000, with financing by Defense Plant Corp. Work is scheduled to be carried out at once.

ILLINOIS—Water, Light & Power Department, Springfield, is arranging post-war expansion program at Lake Side steam-electric generating station, to be carried out over a period of months. Work will include installation of new turbine-generator unit, boiler and auxiliary equipment, and is estimated to cost close to $1,000,000. Burns & McDonnell Engineering Co., 107 West Linwood Blvd., Kansas City, Mo., is consulting engineer.

FLORIDA—Civil Aeronautics Authority, Atlanta, Ga., is arranging call for bids for extensions and improvements in municipal airport at Jacksonville, with mechanical and electrical facilities. Cost estimated about $250,000. Bail Horton & Associates, Hildebrandt Bldg., Jacksonville, are consulting engineers.

DELAWARE—E. I. duPont deNemours & Co., Inc., duPont Bldg., Wilmington, will make extensions in plants at Morgantown, W. Va., Carneys Point, N. J., and Baton Rouge, La., including new buildings, with

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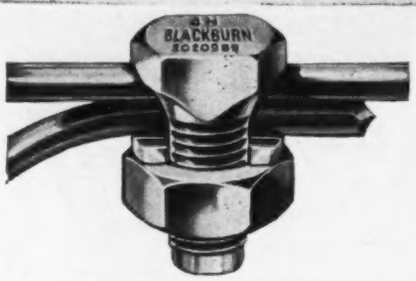


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machinery and electrical equipment. Total cost reported in excess of $650,000. All projects have a priority rating and work is scheduled to begin soon.

COLORADO—Denver & Rio Grande Western Railroad Co., 1531 Stout St., Denver, has arranged fund of about $269,100 for extensions and improvements in signal and traffic control systems during 1944, including additional underground line installations, instruments and fixtures. Also will expend about $253,000 for additional shop buildings at different points, and approximately $251,000 for shop tools, machinery and electrical equipment. Budget has been approved by District Federal Court, and work will begin soon.

GEORGIA—War Department, Washington, D. C., hasapproved plans for rebuilding of warehouses, shops and other industrial structures at Atlanta Ordnance Depot, to replace buildings recently destroyed by fire. Cost estimated about $500,000, with mechanical and electrical equipment. Work will begin at early date and will be supervised by U. S. District Engineers Office, Savannah.

MONTANA—Water Department, Helena, is arranging early call for bids for motor-driven pumping machinery, controls and auxiliary equipment for new pumping station, where new well will be drilled. Also for electric line for power supply and other operating facilities. Cost estimated about $92,000. Project will have a priority rating.

OHIO—Sun Oil Co., Woodville St. and city limits, Toledo, will carry out expansion in butadiene production plant at local oil refinery, for increased capacity for synthetic rubber service for government. Work will comprise several new one and multi-story buildings, with machinery and electrical equipment. Cost estimated about $950,000, with financing by Defense Plant Corp. Work will proceed at early date. Main office of company is at 1608 Walnut St., Philadelphia, Pa.

VIRGINIA—State Department of Prisons, Richmond, plans extensions and improvements in power plant at Southampton Penitentiary Farm, with installation of additional equipment. State Legislature is now considering appropriation of $80,000 for work. Another appropriation of $65,000 is expected to be authorized for similar work at power plant at State Industrial Farm for Women.

MASSACHUSETTS—State Department of Education, 200 Newbury St., Boston, has plans under way for post-war development program at Massachusetts State College, to include expansion and improvements in power plant, with installation of additional equipment, estimated to cost approximately $325,000. Edward C. Brown Co., 77 Summer St., Boston, is consulting engineer.

NEW YORK—Precision Castings Co., Inc., Orchard St., Fayetteville, near Syracuse, will make extensions in plant for production for government, including new one-story building, with machinery and electrical equipment. Cost estimated about $425,000, with financing by Defense Plant Corp. Work will be placed under way soon.

CALIFORNIA—War Department, Washington, D. C., has authorized expansion of arsenal, including new shops, warehouses and other industrial structures, with machinery and electrical equipment. Extensions will be made in electrical distribution system. Entire project will cost about $600,000, and will be carried out under direction of U. S. District Engineer Office, San Francisco.

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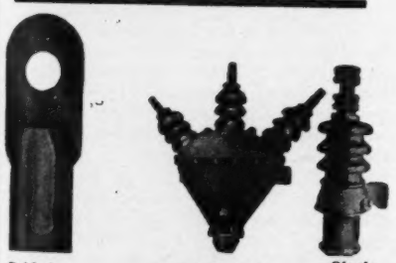


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## Seattle Utility Studies Rate Cut Possibilities

Puget Sound Power & Light Co. is making a study of its rates with a view toward reduction and also toward further improvements in its service, Frank McLaughlin, president, has announced.

Mr. McLaughlin declares that such study is being undertaken "from the viewpoint of the after-the-war situation" as well as on the present showing of the company. "It is my hope that the demand for electrical appliances, beginning immediately after war, will be so great that an electrical-appliance manufacturing industry will develop here in the Puget Sound region . . . where the electric range was developed."

•

## Recent Rate Changes

SEATTLE CITY LIGHT will reduce its rates, effective April 1, $300,000 a year, according to an announcement by City Council utilities committee. The revision will lower the monthly electric bill of every residential customer between 12 and 23 cents, and provides an approximately six percent reduction. The cut represents a three percent cut in City Light's annual income. The only rates to which the reduction will not apply are those of heavy manufacturing industries. Superintendent E. R. Hoffman of City Light recommended the reduction to the Council, declaring that "the greatly increased use of electrical energy justifies such reduction. Of particular significance in the new rates is the reduction of "all-electric" home, Mr. Jones points out. The new rate will provide 400 kw.-hr. of energy a month, instead of the former 370 kw.-hr., for a minimum of $5. He stated that "customers are being converted to that rate as rapidly as possible, and after the war, when the new electrical appliances are again available, that will be the principal rate for residential customers." Addition of the 30 kw.-hr. a month on the "all-electric" home minimum of $5 will not change the charge of 7/10 of a cent of each kw.-hr. over the monthly 400 minimum.

UTAH POWER & LIGHT CO.'s rate case took a new angle recently when OPA filed a petition with the state supreme court seeking to intervene as a friend of the court. OPA is seeking to intervene in the power company's petition to the state supreme court for a review of the Public Service Commission's order of Sept. 11, 1943, which would cut rates about $1,500,000 a year. Chester Bowles, OPA price administrator, is authorized, the petition claimed, to intervene and participate in proceedings before federal, state and municipal authorities in connection with such rates and charges. "The reduction in prices, where profits are excessive, is an essential and integral part of the national policy of economic stabilization, which must apply to all prices and charges, including utility rates," the petition charged. Reversal of the commission's rate-cut order would impair the OPA's efforts to secure utility rate reductions, the petitioner alleged. "It is of utmost importance to the petitioner that the commission's findings be sustained before this court," counsel said. George M. Gadsby, president of Utah Power & Light


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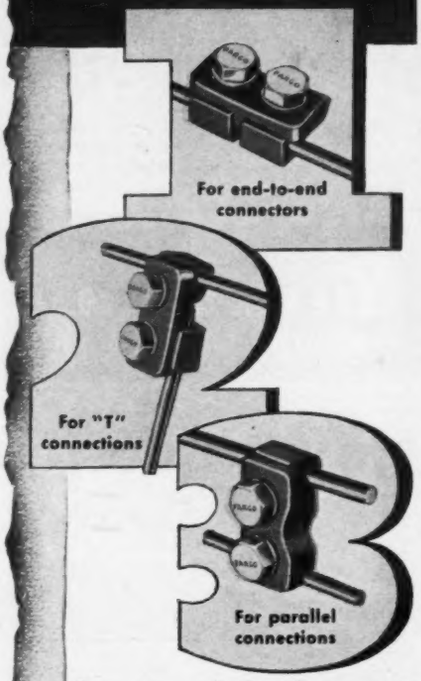


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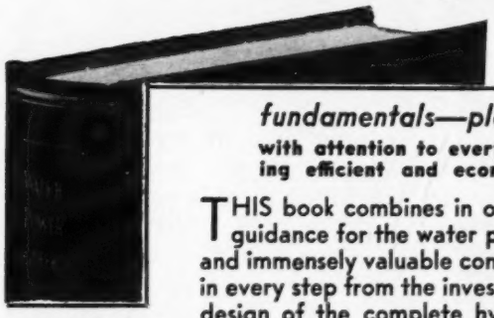

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Co., assailed the petition filed by OPA with the court as an unwarranted encroachment upon state functions and a move which will promote rather than hold the line against inflation. "Electricity," his statement said, "is one of the few things sold at pre-war prices, without rationing, and without change or deterioration in quality of service. Electric rates have not been raised, nor has the company applied for higher rates. The great increase in taxes has been paid by the company—and not passed on to the consumer, directly or through any increase in rates . . . It is difficult to reconcile the position taken by OPA in its petition to intervene . . . The avowed purpose of OPA is to prevent inflation. The people of the country are being urged to put their earnings and savings into war bonds, thereby providing funds so terribly necessary for prosecution of the war and at the same time holding down inflation. Now comes the OPA joining in a case to reduce the pre-war prices for electric service, one of the results of which will be to deprive the federal government of more than $1,500,000 per year in taxes, and to dissipate it mostly in small individual reductions, which are added to current spending power, thereby directly promoting inflation . . ."

ILLINOIS COMMERCE COMMISSION authorized changes in rates during the year ended Dec. 31, 1943, which effected a net annual saving to Illinois utility customers of $3,670,305. Net reductions in annual operating revenue of electric utilities were $167,332—residential, $66,662; small power and light, $1,243; large power and light, $67,205; municipal, $17,722 and rural, $14,500.

WISCONSIN PUBLIC SERVICE CORP. has put into effect in the communities it serves in northeastern and north central Wisconsin a reduction in rates charged for electricity used for municipal water and sewage pumping that will save consumers $18,700 annually. The reduction was ordered by the state Public Service Commission as part of a four-year arrangement with the company to cut its rates. Residential and street-lighting rates were reduced last fall.

CONSOLIDATED GAS ELECTRIC LIGHT & POWER CO. rate charges to the municipality of Baltimore were termed unfair and unreasonable in a petition filed with the Maryland Public Service Commission asking for an investigation and hearing on the subject. City Solicitor Simon E. Sobeloff and Assistant City Solicitor Thomas J. Tingley filed the petition, the action being approved by Mayor Theodore R. McKeldin. The complaint was made in the name of the mayor and city council of Baltimore. Reasons for the city's claims are set forth as follows: "Comparisons and studies of the electric street lighting rates in many other cities, and particularly with those charged in Washington, D. C., show the electric street lighting rates charged in Baltimore to be excessive to the amount of at least $465,269. On a per capita basis, Baltimore has the highest costs for electric street lighting service in 14 cities of 500,000 population and over. By comparison the municipal flat rate charged under the contract . . . to Park Board and domestic rates charged by Gas & Electric Co., appropriate reductions are indicated in a further amount of at least $92,103. By comparison the gas street lighting rates charged under the contract . . . to domestic rates charged by Gas & Electric Co., an estimated further reduction of at least $58,450 is indicated. That the total of such reductions in rates which should, pursuant to the conclusions embodied in the said report, be made, is in the amount of at least $615,822. Because

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of economies effected in metering, billing and collection in the case of service supplied to the city by Gas & Electric Co., lower rate should be charged than in the case of customers where such advantages do not obtain."

PUBLIC SERVICE ELECTRIC & GAS CO.'s new rate schedule, which will yield annual savings of $287,000 to commercial and industrial users of electric power has been approved by the New Jersey Public Utility Commission. The commission had undertaken an investigation of Public Service's rate structure last year after military authorities at Fort Dix and Camp Kilmer had complained. The company then agreed to extend wholesale power rates to the large training camps and to seventy non-commercial users. These rates will save consumers an estimated $135,000 each year.

## LETTER TO THE EDITOR

### Three Methods for Control of Voltage Regulation

*To the Editor of* ELECTRICAL WORLD:

I have noted with interest the series of practical ideas and data which you have been publishing, such as the ones on pages 86, 96 and 102 of the October 2 issue of ELECTRICAL WORLD. I believe that these must find many thankful users in the industry.

I wish to comment, however, on the information under the heading of paragraph 1 on page 86. I believe it would be well to point out that these connections can be easily made only if both ends of the primary winding are brought through bushings to the outside of the tank. In the case of transformers which have one end of the high-voltage winding grounded to the tank (and these are quite common in recent years), the connection shown, if made at all, would have to be made inside the tank. This may be difficult or impossible. Note also that it would be clearer if the caption read: "(a) Normal H.V. rating of 2,400 volts; (b) 5 percent boost of H.V. rating to 2,520 volts; (c) 5 percent buck of H.V. rating to 2,280 volts; diagrams are based on additive polarity."

The idea suggested in paragraph 2 is also very good and it may be desirable to mention an additional method of obtaining this compensation for line drop. In general, it will be found that modern transformers, such as the Westinghouse "Hipersil" transformers, have lower impedances than older transformers. By placing these modern lower impedance transformers farther out on a line and using the older higher impedance units closer to a substation, the same compensation will be obtained as by employing different-sized transformers for the same


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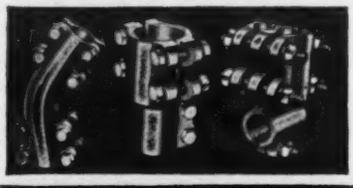

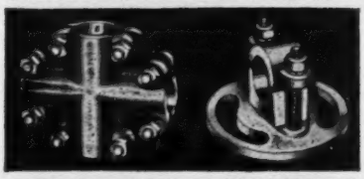

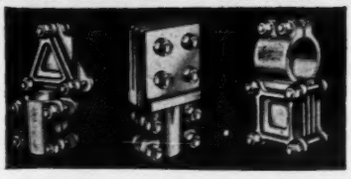

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amount of load. By this method, however, there need be no "overtransformering" and no overloading.

A. D. FORBES,
Transformer Engineering Dept.,
Westinghouse Electric &
Manufacturing Co., Sharon, Pa.

## BOOKS RECEIVED

**Beloved Scientist.** By David O. Woodbury. Whittlesey House, McGraw-Hill Book Co. 358 pages, illustrated. Price $3.50.

Elihu Thomson was, according to this loyally portrayed biography, a chemistry teacher who all his life stayed a guider, inspirer and shaper of men and their achievements. In many ways he out-Edisoned his contemporary Edison yet too often let others receive the laurels for discoveries which he was too engrossed to follow through. Prolific in invention (a patent a month for over 50 years) he was, nevertheless, a discoverer rather than an inventor. His penetrating interest in other matters than the dynamos which were the wee beginnings of the General Electric Company went far afield; they embraced astronomy, aviation, welding, meteorology, photography, x-rays, wireless. In numerous instances he anticipated the disclosures of Marconi, Becquerel, his namesake Lord Kelvin, Siemens, and even Edison himself. Read here of the "battle of the electric lights," the maelstrom of conflicting patents, the tiny beginnings at New Britain, the unfolding at Lynn, the initiation of men who made G.E. and its research, of Faraday, Kennelly, Brush, Westinghouse and Sprague, how the carbon brush saved the street railway industry aborning, why the Oregon got around the Horn in time to smash the Spanish Navy at Santiago.

**Short-Wave Wireless Communication.** By A. W. Ladner and C. R. Stoner. John Wiley & Sons, Inc., New York. 573 pages, illustrated. Price $6.

Marconi engineers are the authors of this fourth edition (first 1932), which puts emphasis on paralleling the treatment of ultra-short and short-waves. Topics developed are modulation (including phase and frequency), propagation, feeders to aerial arrays, push-pull, power amplifiers, oscillators, reception problems, commercial equipments, therapeutic circuits. Treatment is rather qualitative than rigorously mathematical. References are both British and American.

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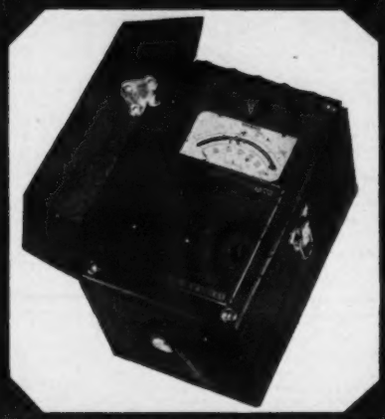

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| Serial | 344 |
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| Turbine | Ridgway-Rateau-Smoot |
| Number | 165 |
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| Combination high and low pressure | |
| RPM | 3600 |
| Steam Pressure | 200# |
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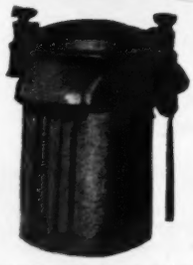

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## D C MOTORS

| | HP | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 2— | 1250 | G.E. | MPC | 550 | 130 |
| 1— | 800 | G.E. | MPC | 600 | 600 |
| 2— | 625 | G.E. | MPC | 500 | 130 |
| 1— | 600 | G.E. | MPC | 600 | 650/900 |
| 1— | 500 | G.E. | MPC | 230 | 900 |
| 1— | 350 | G.E. | MPC | 230 | 450 |
| 1— | 300 | G.E. | DMC | 230 | 400/600 |
| 2— | 300 | G.E. | MPC | 230 | 275/550 |
| 1— | 300 | | | 550 | 250/400 |
| 2— | 270 | Whse. | | 230 | 525 |
| 1— | 250 | Al. Ch. | | 230 | 400 |
| 2— | 200 | Whse. | | 250 | 150/525 |
| 1— | 175 | Whse. | SK | 230 | 800/1600 |
| 1— | 150 | G.E. | RC-19A | 230 | 250/450 |
| 1— | 150 | G.E. | MPC | 230 | 625 |
| 2— | 125 | G.E. | CO-1832 | 230 | 720 |
| 2— | 120 | Whse. | SK-180 | 230 | 1200 |
| 3— | 100 | G.E. | LC-50 | 230 | 950/1150 |
| 1— | 100 | Al. Ch. | | 230 | 225/450 |
| 1— | 100 | G.E. | MPC | 230 | 575/720 |
| 2— | 100 | G.E. | RC-19 | 230 | 500/1000 |
| 1— | 75 | G.E. | LC | 230 | 560/1100 |
| 3— | 75 | Whse. | SK-183 | 230 | 525/1050 |
| 1— | 60 | El. Dy. | 258 | 230 | 500/1000 |
| 3— | 50/60 | Cr. Wh. | 65H | 230 | 300/900 |
| 1— | 50 | Cr. Wh. | CMC-81H | 230 | 400/1600 |
| 10— | 50 | G.E. | RF-16 | | |

## TRANSFORMERS

| | KVA | Make | PH | Type | Voltages |
|---|---|---|---|---|---|
| 6— | 1667 | Pitts | 1 | OISC | 13200x2300 |
| 1— | 1050 | G.E. | 3 | WCTH | 11000x445 |
| 1— | 600 | G.E. | 3 | HT-OISC | 11550x2200 |
| 3— | 333 | Moloney | 1 | C-OISC | 22000/11000x2300/575 |
| 1— | 333 | Whse. | 1 | OISC | 2300x460 |
| 2— | 333 | Pitts. | 1 | OISC | 2400x2.4.0 |
| 1— | 300 | G.E. | 1 | H-RP | 13200x575/1150/2300 |
| 1— | 300 | Pitts. | 3 | ODSC | 4150x208/120 |
| 3— | 300 | Packard | 1 | OISC | 2200x220/440 |
| 1— | 200 | G.E. | 1 | H-LDD | 26400x115/460 |
| 1— | 200 | G.E. | 1 | H-OISC | 2300x115/230 |

## MOTOR GENERATOR SETS

**3 ph. 60 cycle**

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP, 2300 V. Syn. Motor.
1—1000 KW Whse. 600 V. Gen. d.c. to 1400 HP 4000 V. Syn.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW G. E. 250/275 V. Gen. to 700 HP ATI 440/2300/4000 V. Motor.
1—300 KW G. E. 250 V. Gen. to 400 KVA 440 V.
1—100 KW Whse. SK 250 V. Gen. to 150 HP Syn. 2300 V. 900 RPM motor with excit.
1—75 KW G. E. 125 V. Gen. to 120 HP IK 4000/2300 V. motor.

## TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

## ROTARY CONVERTERS

**60 cycle**

| | KW | Make | Speed | D.C. Volt | Trans. Volts |
|---|---|---|---|---|---|
| 1— | 1500 | Whse. | 720 | 600 | 2300 |
| 1— | 1500 | Whse. | 900 | 600 | 11500 |
| 1— | 1250 | G.E. | 720 | 250 | 2300 |
| 1— | 1000 | G.E. | 900 | 600 | 13200 |
| 1— | 1000 | Whse. | 900 | 600 | 11000 |
| 1— | 750 | G.E. | 1200 | 600 | 2300 |
| 1— | 750 | Whse. | 720 | 250 | 6600/2300 |
| 1— | 500 | Whse. | 1200 | 600 | 13200/2300 |
| 1— | 375 | G.E. | 1200 | 250 | 6600/2300 |
| 3— | 300 | G.E. | 1200 | 600 | 2300 |

**25 cycle**

| | | | | | |
|---|---|---|---|---|---|
| 2— | 1500 | G.E. | 500 | 225/275 | 13200/6600 |
| 1— | 500 | G.E. | 750 | 225/275 | 13200/6600 |

All units can be furnished with AC and DC controls.

## A. C. MOTORS

**3 ph. 60 cycle**

**Synchronous**

| | HP | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 1— | 500 | G.E. | TS | 440 | 360 |
| 1— | 400 | G.E. | ATI | 440 | 720 |
| 1— | 225 | G.E. | ATI | 240 | 600 |
| 1— | 150 | Al. Ch. | | 2300 | 900 |
| 1— | 150 | Whse. | | 2200/550 | 1800 |
| 1— | 125 | G.E. | ATI | 220/440 | 900 |
| 2— | 100 | Whse. | G | 2200 | 1800 |
| 1— | 75 | G.E. | TS-7556 | 220/440 | 600 |

**Slip Ring**

| | | | | | |
|---|---|---|---|---|---|
| 1— | 1200 | Cr-Wh. | 801-Q | 2200 | 237 |
| 1— | 800 | Whse. | CW | 440 | 357 |
| 1— | 800 | Al. Ch. | | 440 | 885 |
| 2— | 600 | G.E. | IP | 440/2200 | 720 |
| 1— | 450 | Whse. | CW | 2200 | 875 |
| 1— | 400 | G.E. | IP | 440/2200 | 600 |
| 1— | 400 | Al. Ch. | | 2300 | 505 |
| 1— | 350 | G.E. | IM | 2300/4000 | 257 |
| 1— | 300 | Whse. | CW | 440 | 585 |
| 1— | 300 | G.E. | IM | 440 | 720 |
| 2— | 250 | G.E. | MT | 440 | 450 |
| 1— | 250 | G.E. | MT | 4000/2300 | 257 |
| 2— | 200 | G.E. | IE-M | 2200 | 1750 |
| 2— | 200 | Whse. | CW | 2200 | 514 |
| 1— | 200 | G.E. | IM | 440 | 600 |

**Squirrel Cage**

| | | | | | |
|---|---|---|---|---|---|
| 1— | 500 | G.E. | 1-17B | 2200 | 695 |
| 1— | 400 | Whse. | CS-1104A | 2200 | 585 |
| 1— | 300 | Whse. | CS | 550 | 580 |
| 1— | 300 | G.E. | IK | 2300 | 600 |
| 1— | 250 | Al. Ch. | | 220/440 | 1150 |

## SYNCHRONOUS CONDENSERS

| | | | | | |
|---|---|---|---|---|---|
| 1— | 1000 | G.E. | ATI | 2200/3800 | 900 |
| 1— | 750 | G.E. | ATI | 220/440 | 900 |
| 1— | 600 | G.E. | ATI | 220/440 | 900 |

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1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—400 HP, 514 RPM, 440 volt, Westg., slip ring
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—500 HP, 900 RPM, 440 volt, Lincoln slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E., sq. cs.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E., vertical

### MOTORS—D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1— 65 HP, 1000 RPM, G.E., type RC.
1— 50 HP, RPM, Westinghouse, type SK.

### TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
2—200 KVA, G.E., 2200-220/440 volts.
2—200 KVA, Allis-Chalmers, 2200/220/440
3—150 KVA, G.E., 33,000 2300/4000 Y.
2—100 KVA, Westinghouse, 11,430/250 volts
3—100 KVA, G.E., 2300-220/110 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110
3—100 KVA, Allis-Chalmers, 2400/4150Y-2400
3— 75 KVA, General Electric 2200/220/440.

### MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, synchronous.
1— 75 KW, 125 volt, General Electric, squirrel cage.
1— 6 KW, 125 volt, General Electric, squirrel cage.

### MOTORS—VARIABLE SPEED 230 VOLTS

1—150 HP, 350/1050 RPM, Crocker-Wheeler.
1— 90 HP, 470/940 RPM, General Electric.
1— 75 HP, 525/1575 RPM, Electric Dynamic.
1— 35 HP, 500/1500 RPM, Westinghouse.
1— 35 HP, 350/1050 RPM, Electric Dynamic.
1— 30 HP, 225/900 RPM, Crocker-Wheeler.
2— 25 HP, 300/900 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker-Wheeler.

### ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

### TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

### ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator. Fairbanks company engine.

**Complete Line of A.C. and D.C. Motors and Generators**

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D.C. Watt hour meters, Ammeters & Voltmeters, switchboard type, also 10,000 amp. Shunts.

**NEWARK NEWS, Newark, N. J.**

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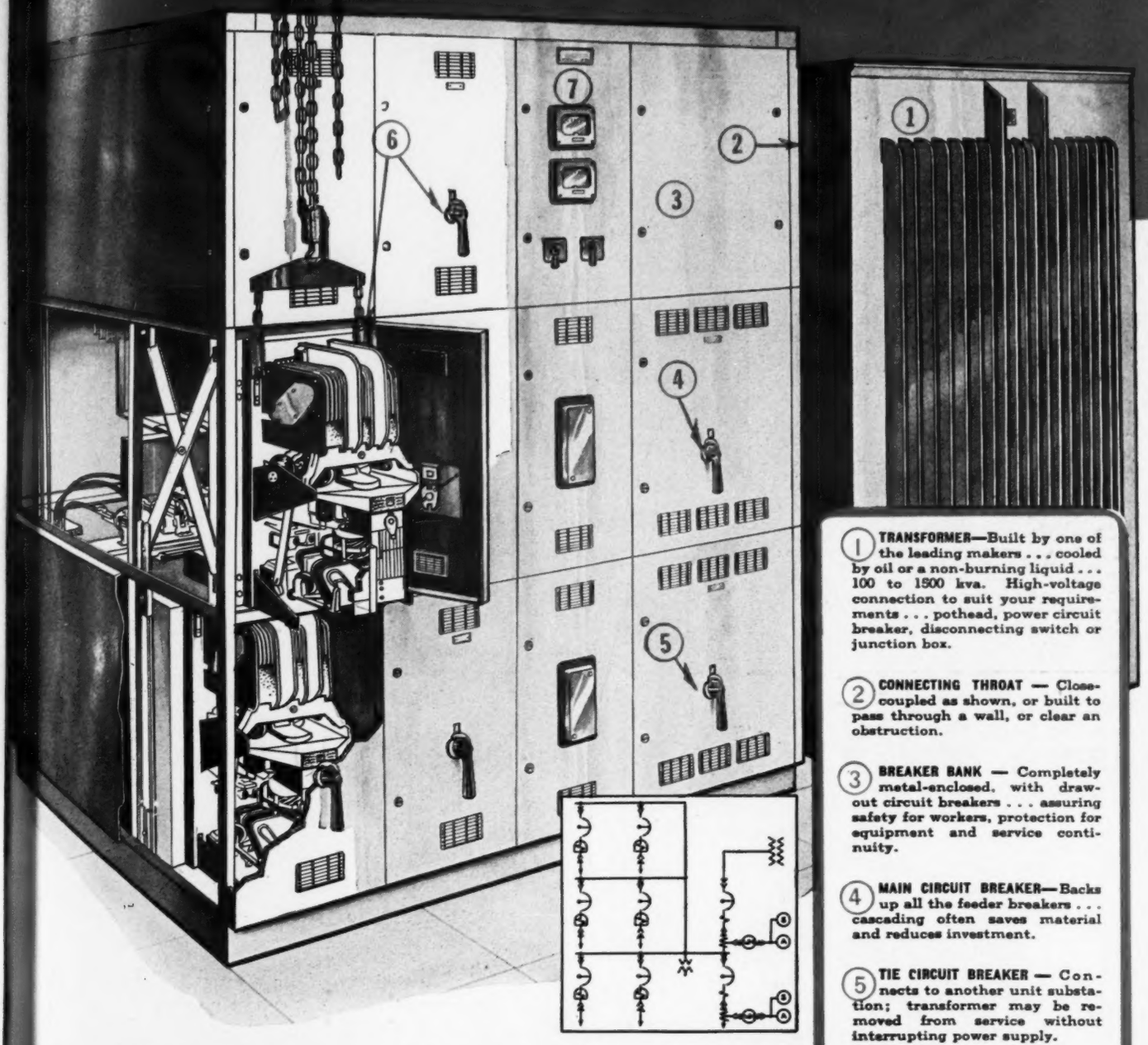
**★ These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

# I-T-E DRAWOUT SWITCHGEAR

## Features You Want in Unit Substations




(1) **TRANSFORMER**—Built by one of the leading makers . . . cooled by oil or a non-burning liquid . . . 100 to 1500 kva. High-voltage connection to suit your requirements . . . pothead, power circuit breaker, disconnecting switch or junction box.

(2) **CONNECTING THROAT** — Close-coupled as shown, or built to pass through a wall, or clear an obstruction.

(3) **BREAKER BANK** — Completely metal-enclosed, with drawout circuit breakers . . . assuring safety for workers, protection for equipment and service continuity.

(4) **MAIN CIRCUIT BREAKER**—Backs up all the feeder breakers . . . cascading often saves material and reduces investment.

(5) **TIE CIRCUIT BREAKER** — Connects to another unit substation; transformer may be removed from service without interrupting power supply.

(6) **FEEDER CIRCUIT BREAKERS**—Drawout type . . . spare breaker may be substituted during periodic inspections.

(7) **BUS TRANSITION FRAME** — Provides for branching buses . . . instruments may be mounted on doors.

Advantages of Unit Substations have led to rapid adoption and will lead to much wider use—saving in cable copper, reducing voltage drop by employing short feeders, saving in space with compact arrangement of indoor transformers and breaker banks, quick installation and equally simple removal to a new location.

Design and construction of the unit are important in providing such advantages in fullest measure.

The features of design and construction identified on this page are but a few that I-T-E engineers will gladly go over with you.

*Representatives in Principal Cities*

I-T-E

**AIR SWITCHGEAR**

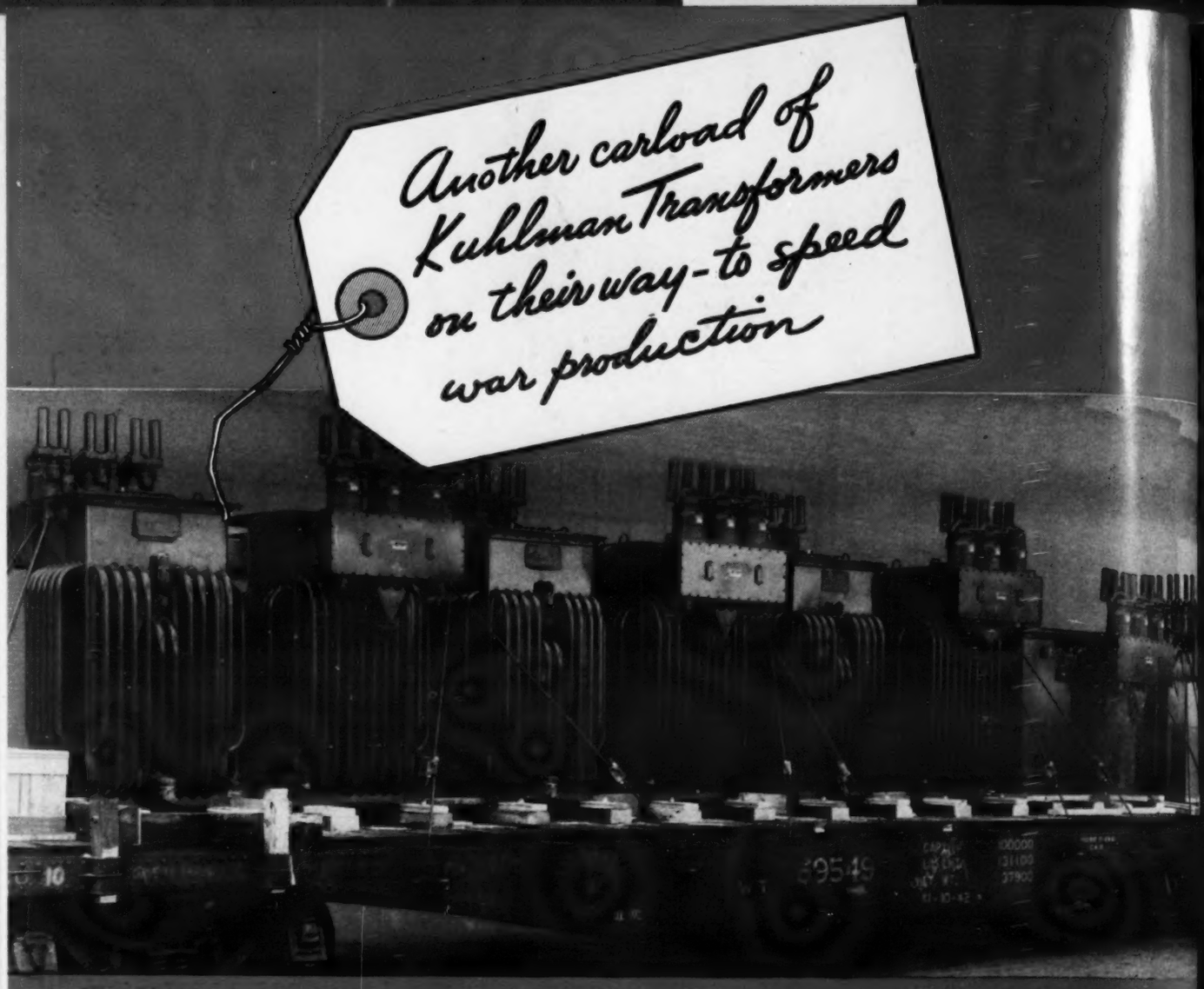
IMMERSED IN AIR — ENCASED IN STEEL

ARMY E NAVY

The Army-Navy "E" for Production Excellence

I-T-E

**CIRCUIT BREAKER CO., PHILADELPHIA 30, PA.**




## KUHLMAN TRANSFORMERS HIGHLY REGARDED BY BOTH INDUSTRIAL AND UTILITY ENGINEERS

The three-phase, 60 cycle, 2400 volt primary OISC Kuhlman Transformers shown here are on their way to one of America's vital war plants. High voltage side is equipped with gang-operated oil fuse cut-outs. Secondary outlet is enclosed in a rectangular compartment with facilities for cubicle or duct installations.

No detail is overlooked in the mechanical or electrical construction of these power transformers. Tap changers, tap leads, frame, case, and all the other component parts are designed and built to easily withstand the stress and strain of constant heavy loads.

Hundreds of Kuhlman Power Transformers giving uninterrupted service year after year all over America provide the best proof of the durability and efficiency of these well-designed, well-built units. Write today for complete facts.

Kuhlman ELECTRIC COMPANY, BAY CITY, MICHIGAN